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ATCCIS Working Paper 7L

OPERATIONAL AND PROCEDURAL REQUIREMENTS FOR DATA MANAGEMENT AND STANDARDIZATION

EDITION 1

June 1989

Prepared for
Office of the Assistant Secretary of Defense (C^3I)
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This document is a reprint of a document prepared by IDA in support of a SHAPE-sponsored Army Tactical Command and Control Information System (ATCCIS) Phase II study effort. ATCCIS is a common Army command and control system concept for the year 2000 and beyond. This document describes an approach to achieve data standardization in support of the development of information exchange requirements. The document presents a framework that has been developed for consideration by military, national, and international bodies in support of data management and standardization efforts. Specifically, an integrated framework for a common SHAPE data concept, a common structuring of data, a common glossary, a common SHAPE data attribution list, and a SHAPE and NATO policy mechanism to achieve data standardization are discussed. The document has identified data standardization as a critical and necessary element required to achieve interoperability in combined, joint, and coalition warfare operational environments.

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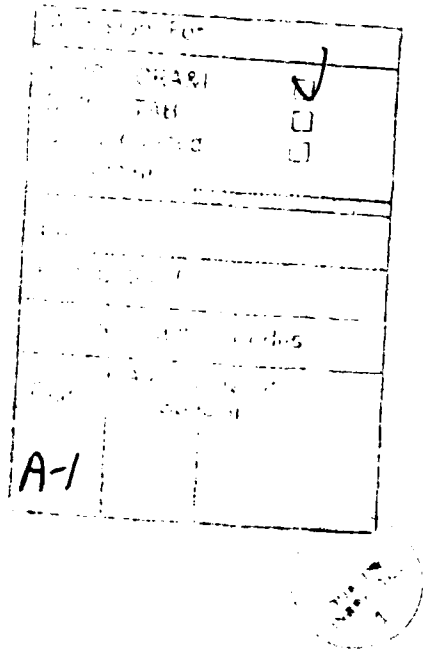

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FOREWORD

(U) This is Edition 1, ATCCIS Working Paper 7L, prepared for the Office of the Director of Information Systems for Command, Control, Communications, and Computers (ODISC4), Headquarters, Department of the Army, in support of the SHAPE-sponsored Army Tactical Command and Control Information System (ATCCIS) Phase II study effort. The contents of this document[1] were developed and agreed to in the international ATCCIS forum and, consequently, were not subject to the normal IDA technical review process. SHAPE has distributed ATCCIS Working Paper 7L to those NATO nations and agencies that have expressed an interest in the ATCCIS study.

(U) Background information relating to the overall ATCCIS effort is contained in the Preface of this Working Paper. It should be noted that Oxford English spelling conventions are used throughout the paper in accordance with standing NATO guidelines. Additionally, emerging international and NATO technical terminology is used throughout the paper. Other ATCCIS working papers will be using this terminology in future editions.

(U) ODISC4 provides the U.S. delegate to the ATCCIS PWG, which consists of military, technical, and analytical representatives from France, Germany, the United Kingdom, the United States, SHAPE, SHAPE Technical Centre, and the Allied Forces Central Europe (AFCENT). The ATCCIS Steering Group provides overall direction and approval of the ATCCIS PWG work effort and includes representatives from the PWG nations and commands, plus Belgium, Canada, and the Netherlands, with additional representation (observers) from the Allied Data Systems Interoperability Agency (ADSIA), the NATO Communications and Information Systems Agency (NACISA), and the Tri-Service Group for Communications Electronic Equipment (TSGCEE). The Command and Control Division, U.S. Army Combined Arms Combat Development Activity, provides military expertise; the U.S. Army Communications-Electronics Command and IDA provide technical expertise, with additional support provided by the National Institute for Science and Technology (NIST); and IDA provides analytical expertise in support of the U.S.

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[1] (U) This document was prepared in response to a request from the Office of the Assistant Secretary of Defense (C^3I), Theater and Tactical Command, Control, and Communications under Contract MDA903-84-C-0031, Task Order T-J1-246, UNCLASSIFIED.

contributions to the overall ATCCIS effort. Further details concerning the ATCCIS Phase II study can be found in the ATCCIS Work Plan.[2]

(U) This paper should be of primary interest to those Commands and Agencies whose focus is on the technical aspects of longer-term command and control requirements. Edition 1 of ATCCIS Working Paper 7L was reviewed by a panel of field-grade officers and senior scientists representing SHAPE, AFCENT, France, Germany, the United Kingdom, and the United States prior to its distribution by SHAPE. Comments from NATO and National Commands and Agencies have been solicited and will be incorporated into a final edition scheduled for later publication.

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2 (U) *ATCCIS Phase II Work Plan*, Edition 2, IDA Memorandum Report M-263, September 1986, UNCLASSIFIED.

PREFACE

1. (U) In 1978, NATO's Long-Term Defense Plan (LTDP) Task Force on Command and Control (C2) recommended that an analysis be undertaken to determine if the future tactical Automatic Data Processing (ADP) requirements of the nations, including that of interoperability, could be obtained at a significantly reduced cost when compared with the approach that had been adopted in the past. The Task Force also recommended that the analysis should determine whether tactical ADP systems could be developed according to technical standards prescribed by NATO and agreed upon by the nations.

2. (U) In early 1980 the then Deputy Supreme Allied Commander Europe initiated a study to investigate the possibilities of implementing the Task Force's recommendations. Three nations, those with experience in fielding automated tactical command and control information systems, participated in Phase I of the study, with Supreme Headquarters Allied Powers Europe (SHAPE) as leader and coordinator. The study group reported, at the end of Phase I, that the nations could increase interoperability and potentially reduce costs by using a common development approach. It was also recommended that Phase II, the definition of an operational and technical concept and an analysis of the likely impact of a common Central Region (CR) (tactical) command and control information system, should be initiated.

3. (U) The ATCCIS study, under the direction of a steering group chaired by SHAPE and consisting of representatives from the CR nations and Allied Forces Central Europe (AFCENT), was established in 1984. Concurrently, a permanent working group (PWG) was formed which consists of military, technical, and analytical representatives from France, Germany, the United Kingdom, the United States, SHAPE and AFCENT, and technical support from SHAPE Technical Centre (STC) to progress the Phase II effort. The Phase II study effort commenced in January 1985.

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OPERATIONAL AND PROCEDURAL REQUIREMENTS FOR DATA MANAGEMENT AND STANDARDIZATION[1] (U)

1. INTRODUCTION

1.1 Derivation

(U) This working paper has been produced in support of Task 4-B-4 [Ref. 1] of the SHAPE-sponsored ATCCIS study for a tactical command and control (C2) system concept for the year 2000 and beyond.

(U) The critical need for NATO data management standardization has been clearly identified by both the Allied Data Systems Interoperability Agency (ADSIA) [Ref. 3] and SHAPE [Ref. 4]. SHAPE Technical Centre (STC) has developed a general approach and has recommended standardizing data management methodologies [Ref. 5], but data management standards in several areas need to be developed for uses throughout NATO, including ATCCIS.

(U) Data element standardization[2] supports the sharing of information and data through uniform data representation, consistent interpretation, and common understanding. Data element standardization is necessary to define and implement Information Exchange Requirements (IERs). Specific objectives of data element standardization are to:

a. Ensure that data are treated as a Command and Control Information System (CCIS)-wide resource to be shared to facilitate the coordination, control, and management of IERs

b. Reduce the cost of managing data by eliminating duplication and redundancy

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1 (U) Reference for spellings in ATCCIS is the *Oxford English Dictionary*. Oxford University Press, Oxford, 1971 (21st Printing, 1981).

2 (U) Note: Data element standardization specifies the definition and representation of data elements, but in no way specifies which data elements "should be" parts of IERs. Data standardization provides guidance for expressing requirements, but not for the requirements themselves.

c. Provide an approach to data element standardization for use throughout ATCCIS and, potentially, other CCISs

d. Provide a means to ensure consistency of data throughout NATO and cooperating national databases and information systems.

(U) Data element standardization provides an opportunity to improve the quality and consistency of specification of current and future IERs. Data element standardization presupposes that national agreement is reached in formulating and structuring the required data elements.

(U) The complete development of an integrated database to meet these requirements is both an operational and technical undertaking, and will evolve over a long period of time. Working Paper 7N[3] will present the overall process of developing the necessary technical basis for the generation of an integrated set of databases for future systems. This paper addresses the operational input to that overall process.

1.2 Purpose

(U) The purpose of this working paper is to provide an operational input to data management and to provide specific recommendations for data standardization. By providing specific recommendations, this paper is intended to promote detailed discussions that could result in early promulgation of standards.

1.3 Scope

(U) The scope of data element standards encompasses data used to support CCIS missions and goals in support of coalition warfare and the entire spectrum of conflict (peace, transition to conflict, and conflict). It also encompasses data required to support some agencies external to the armies. Standardized data elements should be used in specifying IERs for all CCISs.

(U) Standardization procedures provide for the documentation needed to coordinate data sharing across the armies. ***Data element standardization is necessary but not sufficient for the technical specification of an automated database (see Working Paper 7N for a discussion on the technical issues involved).*** Information system redesigns provide the opportunity to align existing data requirements

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[3] (U) Working Paper 7N on Technical Requirements for Data Management and Standardization is currently being developed by the ATCCIS PWG Technical Group. Publication date to be determined.

with the standardized data elements. Where appropriate, data elements currently used in existing CCIS databases should be considered for adoption as standardized data elements.

(U) This paper accomplishes several goals:

- Recommends that a NATO glossary be developed that defines all the terms to be used to name and characterize the structure of data elements
- Recommends a naming convention for the identification of data elements
- Recommends an attribute set for characterizing data representations
- Identifies requirements and proposes an approach for the policies and procedures necessary to implement and maintain effective data management.

1.4 Structure of the Paper

(U) Chapter 2 provides the background for data standardization. The approach for data standardization is based on structural attributes rather than how the data are used. Chapter 3 presents the basic concepts for data standardization, including the concepts of data, data element, data value, and data field. Chapter 4 presents, based on proposed draft International Standards Organization (ISO) standards, the conceptual framework for the structure of data. Chapter 5 discusses the need for a Glossary to support data standardization. Chapter 6 proposes a data element naming convention. Chapter 7 presents a set (viewed as a minimum set) of attributes need to specify (e.g., in a data dictionary) administrative, representational, and relational information about data elements. Chapter 8 discusses requirements, policies, and procedures for data management. A key element of the data management concept is the role of functional experts to specify information standards. The paper concludes in Chapter 9 with a summary of the conclusions and recommendations.

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2. BACKGROUND FOR DATA STANDARDIZATION

(U) Interoperability for ATCCIS is defined as the exchange of information that preserves meaning and relationships.[4] Data standardization is required to provide consistent structure for representing these meanings and relationships for data elements that support the IERs. In this context, the term "data element" refers to the lowest level or simplest expression of data that is to be represented, stored, processed, or transmitted.

(U) The data management problem is how to identify, name, and structure data elements in a consistent (and nonredundant) fashion to support NATO degree five interoperability, while reducing, or at least controlling, the cost of modifying or developing ATCCIS-conformant systems. Data management is required for correlating IERs, designing databases, formatting and analysing message texts, and identifying manual procedures.

(U) An immediate solution for the data management problem in Allied Command Europe (ACE) is required. Further, there is not yet an integrated solution (or approach) defined for NATO in data management. A discussion of the policy and recommendations provided to date is given in Sections 2.1 and 2.2.

(U) Each data element in a CCIS needs to have associated with it:

- A unique name that is structured to prevent data redundancy
- Representations for data values (e.g., formats, range of acceptable values)
- Indication of the accuracy of the data element (e.g., four significant places)
- Specification of the unit to be used (e.g., litres)
- Additional structure to represent the relationships of this data element to other data elements (e.g., associating a facility name with a logical address)
- Supportive descriptive text.

An overview of concepts for data and data standardization is presented in Chapter 3 and 4.

(U) The concepts to be used for names and structure must be consistent with international standards and be able to present hierarchical and other relationships. Names

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[4] (U) The basis for interoperability in ATCCIS is the degree five interoperability concept as defined in the 15 December 1987 draft NATO Interoperability Planning Document (NIPD) [Ref. 8].

themselves will be given structure. Specifically, naming conventions include a fundamental descriptor, some modifiers, and some additional qualifiers. The descriptors and modifiers would specify not only the type of that data element, but also a clear indication of what that data element is. One of the underlying principles of data standardization is that data elements are based on "what is represented" rather than on "how the data are used." Modifiers would also indicate, where appropriate, the organizational context or meaning for the data element.

2.1 NATO Policy

(U) The ATCCIS Permanent Working Group (PWG) understands that NATO policy for data management is the responsibility of the NATO Communications and Information Systems Committee (NACISC). However, no NACISC policy statements have been found for data management. This section summarizes the progress being made to establish the need for and to develop NATO policy for data management.

(U) The Chairman of ADSIA has clearly stated [Ref. 6] the need for a policy for data management in the NATO CCIS:[5]

> The introduction of automated data bases in NATO Commands and Headquarters over the past decade has raised the need for interoperability standards for automated information exchange among data bases and for a scheme for data management to insure data integrity and consistency with CCIS data bases. Various NATO authorities are already forced to address those activities to satisfy specific system needs, and this number is increasing....[S]erious attention should be given to:
>
> - The establishment of a NATO data management policy,
> - The development of a NATO CCIS data dictionary,
> - The development of interoperability standards for database information exchange.

(U) The NATO Interoperability Management Plan (NIMP) [Ref. 7] specifically identifies standards and rules for representing data as procedural standards and assigns the responsibility for these standards to ADSIA. Further, the NIMP states:

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5 (U) The NATO CCIS or NCCIS is the aggregation of NATO Headquarters systems, NATO Command systems, NATO Agency systems, national-NATO dual-role systems, and national systems that interface to NATO.

> In order for the information exchange to be effective, it is necessary that the meaning and relationships associated with [information received from other facilities] is common and preserved, irrespective of the interoperability service and transmission media. A single common definition for all operational information throughout NATO is needed to achieve this goal. (Emphasis added)
>
> ...[A] common information exchange glossary [is] essential to the development of unambiguous and operationally satisfactory information procedural standards.
>
> It is NATO policy to maximize the commonality of the different system-dependent standards where there exists a validated operational requirement and where this is economically acceptable. The areas in which commonality shall be sought include operational terminology, expression at the representational level and system architecture.

(U) An early draft of the NATO Interoperability Planning Document (NIPD) Volume 2 [Ref. 8] had an annex (Annex D, now discarded) that described a Common Information Exchange Language (CIEL) that was a predecessor to the current ADSIA initiative to develop a NATO Glossary of Operational Terms (GLOT). Details are provided in Chapter 5. The NIPD will address formal specification of IERs and the development, configuration management, testing concept, and documentation plan for NATO Common Interoperability Standards (NCIS). The NIPD is still in development, with drafts of the six volumes planned for completion in 1989 and agreement in 1990. Drafts of Volume 2 (Formal Specification of IERs), Volume 3 (Plan for Development of NCIS), and Volume 4 (Plan for Configuration Management of NCIS) have been completed [Ref. 9]. Volume 2 will specify the six degrees of NATO interoperability.

(U) Data management continues to be carried as an open issue on the agendas of the Information Systems Working Group (ISWG) and the ADSIA Plenary.[6] The ISWG has been invited [Ref. 10] by the ADSIA Plenary to develop a NATO policy on (1) data management and (2) the use of database management systems in the NATO CCIS. ADSIA would use this policy for the identification and collection of related standardization requirements.

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6 (U) Both the ISWG and ADSIA are part of the NATO Communications and Information Systems Organization (NACISO), whose executive body is the NACISC.

2.2 Overview of Existing and Emerging Standards

(U) This paper will recommend an integrated framework for data management that brings together the efforts and development already initiated in a number of NATO Technical Memorandums and other papers, as well as from international commercial standards. Selected NATO standardization agreements (STANAGs) were reviewed to identify potential bases for data management standards. This section summarizes the status of standards and recommendations from these sources.

2.2.1 Existing and Emerging ISO Standards

(U) The International Standards Organization (ISO) and the International Electrotechnical Commission (IEC) Joint Technical Committee 1 (JTC1) has issued a draft standard, DP 7826, on the representation of data elements [Ref. 11]. This draft proposal sets out standard procedures for the identification and representation of existing and new coding systems, without providing any guidance on specific coding systems. It also specifies a technique for interchange of coded representations and the requirements for the administration of International Coding System Identifiers (ICSIs). This will permit the use of more than one coding system, reduce the possibility of ambiguity, reduce the need for human intervention, and diminish the time required to negotiate interchange of coded representation agreements.

(U) ISO/IEC DP 7826 identifies three types of data element attributes: administrative, relational, and representative. These are the types of attributes described in this Working Paper and recommended for ATCCIS in Chapter 7.

(U) Substantial work has been done cooperatively by ISO/IEC JTC1/SC14 and American National Standards Institute (ANSI) X3L8[7] during the last three years, and a draft proposal for data management is expected sometime in 1989. Once accepted by the working groups, this draft proposal will be offered to ISO for adoption [Ref. 12]. The general approach to the structure of data (Chapter 4) was derived from discussions with ISO/IEC JTC1/SC14 and ANSI X3L8.

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7 (U) A member of the U.S. Technical Advisory Group to ISO/IEC JTC1/SC14 and of X3L8 is an active participant in the ATCCIS PWG and contributed to this Working Paper.

2.2.2 STANAGs and TSGCEE Recommendations

(U) The purpose of AAP-6, *NATO Glossary of Terms and Definitions (English and French)* [Ref. 13], is to standardize operational terminology used throughout NATO, thereby promoting mutual understanding. The criterion for inclusion is that the term be of a general military application. While earlier editions put qualifiers immediately following the term, such qualifiers are now embedded in the definition. In addition, terms and definitions are not to be composed of, nor contain, abbreviations and acronyms. A term and definition are only included in the glossary when they have been agreed upon by all nations in both English and French.

(U) An early standard, no longer in effect, was ADatP-1 (STANAG 5550) [Ref. 14], *NATO Standard Data Elements, Data Items, and Codes*. This standard was developed to specify the rules and procedures in developing standard data suitable for use in both manual and computer-assisted environments for the exchange of information between national and NATO authorities.

(U) The terms defined in ADatP-2 [Ref. 15], *Automatic Data Processing (ADP) NATO Glossary, English and French,* are derived from glossaries, dictionaries, and vocabularies from ANSI, American National Directory for Information Processing (ANDIP), ISO, International Business Machines (IBM), and ACP 167. The definitions are annotated by source and may include abbreviations, examples, notes, diagrams, accepted synonyms, contrasting terms, related terms, and cross-references for multiple uses. When harmonization is being examined for multiple uses of a term, this information is noted.

(U) ADatP-3 (STANAG 5500) [Ref. 16], *NATO Message Text Formatting System (FORMETS),* provides the rules, constructions, and vocabulary for standardized character-oriented message text formats that can be used in both manual and computer-assisted operational environments.

(U) Allied Communications Publication (ACP) 167(F) [Ref. 17], *Glossary of Communications-Electronics Terms,* provides definitions of terms used by communications, electronic warfare, and operational personnel for Allied networks.

(U) STANAG 5621 is one of many operational standards that provide procedures for embedding data fields into (character-oriented) message text formats. ***However, it does not provide a structured method for the integration, identification, or naming of data elements that is applicable across multiple media.*** Users provide free-form names for data fields. Associated with each data field is a set format

identifier, whose first character indicates whether the data field set format is designed for columnar information.

(U) STANAG 4222, *Standard Specification for Digital Representation of Shipboard Data Parameters*, is a naval standard that addresses naming conventions [a product of the NATO Industrial Advisory Group (NIAG) WG6]. This STANAG addresses the specification of digital representation of shipboard embedded data parameters only.

(U) The NATO Technical Common Interoperability Standards (TCIS) Transition Strategy [Ref. 18] recommends a number of ISO standards for use until the TCIS are available. These technical standards include ASN.1 (ISO 8824), ASN.1 Basic Encoding Rules (ISO 8825), and Association Control Service Elements (ASCE, ISO 8650), which could support the procedural standards recommended in this Working Paper for data management.

2.2.3 Other NATO Directives and Recommendations

(U) In 1985, STC published a Technical Memorandum (TM), *Data Management Standardization for ACE ACCIS, TM-776* [Ref. 5]. This paper recommends standardization of the architecture, functionality, and structure of the Data Management Subsystem (DMS) of the ACE Automated Command and Control Information System (ACCIS). These areas of standardization include data management methodologies and the tools needed to design, build, and maintain the ACE ACCIS databases. TM-776 accomplished the following:

- Recommended standard data elements and relationships be placed into an ACE common data structure.
- Identified a schema as consisting of a definition of all application object types, including their attributes, relationships, and static constraints, where a database is an instance of a schema.
- Identified the need for a methodology for formal definition of data elements based on standardized terminology, including the use of naming conventions.
- Identified the requirement that the Data Management Subsystem (DMS) at every ACE ACCIS node must agree upon the semantics and syntax of the information exchange.
- Stated that a classification method must be based on the principle of sorting data according to the type of information provided by their values, independent of their use in particular databases, messages, or applications

- Defined a data element as a basic unit of data which has a name, a definition, and a set of values for representing particular facts. A data element and its definition should not include any application or usage information.
- Stated that determination of names following rules and classification of data elements brings out common data features and helps the correlation process. A method of analysing, defining, and controlling data elements has three components: a type classification of data elements, syntax rules for the structure and completeness of formal definitions, and a controlled vocabulary of permitted terms for formal definitions. (Note: the concept of generic element is introduced in Chapter 3 to provide for these features.)

(U) In April 1986, ADSIA revised a working paper, "The Need for Standardization of Data Management and Data Base Information Exchange in the NATO CCIS" [Ref. 3], on the need for standardization of data management. The following actions were recommended and agreed to, ***but without any binding commitments of the nations to implement them:***

- NATO Communications and Information Systems Agency (NACISA) to identify and collect the requirements for database management systems and for standardization of database schemes, file transfers, database information exchange, and configuration management procedures
- Subsequently, ISWG to develop a NATO policy on data management and on the use of database management systems in NATO CCISs
- ADSIA to coordinate the development of technical and procedural standards for databases
- ADSIA to develop the procedural standards for database information exchange
- TSGCEE Subgroup 9 on Data Processing and Distribution to develop technical standards for database schemes and file transfer
- NACISA to control the implementation of the developed standards and NATO policy paper to ensure the interoperability of command and control systems within the NATO CCIS.

(U) In October 1988, SHAPE distributed AM 96-1-4, *Data Management* [Ref. 4]. This manual concentrates primarily on administrative aspects of data management, specifically the responsibilities of a Data Administrator and a Database Administrator.[8] It states:

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8 (U) AM 96-1-4 is binding only on SHAPE. As such, it does not necessarily provide for NATO-wide policy.

- The purpose of data management is to provide methods to ensure data availability, security, integrity, quality, and interoperability, and to provide data sharing.
- Defines data as representing the elementary facts, descriptions, and qualifications about things of interest to some headquarters, unit activity, or enterprise.
- Defines an attribute as a definitive characteristic of a data element or data item that quantifies, identifies, or describes its representational, administrative, or relational concept.
- Defines the role of a data dictionary as an automated tool that provides a centralized library of metadata covering all aspects of all types and structures of data residing in databases, file systems, and manual systems within an organization. Aspects identified are:
  - origin and ownership of data
  - attributes (name, number, code language mnemonic, synonyms, format, range of values)
  - definitions
  - usage (applications, reports, physical forms)
  - location (files, schemas)
  - destination (data flows)
  - security classification
  - relationships
  - dispositions.
- Asserts: Evolution towards an ACE ACCIS will only succeed from the data management point of view by ensuring that the standardization of data definitions, the control of the data, and the maintenance of its overall integrity are systematically established on a command or site basis.
- Asserts: The fundamental key to data management is the early definition and identification of data elements and, later, data fields. The definition and corresponding name should be clear, accurate, and meaningful, but reference should be given to connotation, which relates to the interpretation that bears upon the specific context of usage of data.

2.2.4 Other Data Management Standards

(U) The naming convention and rules presented in this paper have been derived from an emerging standard from the National Institute for Science and Technology (NIST), *Guide to Data Entity Naming Conventions* [Ref. 19], that is expected to be offered to ISO

in the near future. Specifically, the general format of the convention is consistent with this publication. However, the rules have been expanded to support the concepts and structure of data consistent with the needs in NATO, SHAPE, and ATCCIS, as well as the emerging ISO taxonomy. The attribute list presented in Chapter 7 is a superset of the element level of ISO/IEC DP 10027, *Information Processing Systems--Information Resource Dictionary System (IRDS) Framework* of 1 April 1988. The attribute list (as well as the rules) has been expanded to incorporate needs that have been identified in NATO, SHAPE, and ATCCIS. The overall guiding philosophy has been to integrate all possible sources of information on data management, standardization, standards, structure, classification, and typing.

(U) The concepts and constructs contained within this paper are consistent with the emerging IRDS standard, ISO/IEC DP 10027. The IRDS specifies the Element Entity (i.e., data element) as the lowest level of the dictionary framework. Unfortunately, the IRDS does not address the constructs that make up the Element Entity, nor does it provide a convention that can be used to support the Element Entity. This paper supports and completes the Element Entity as defined within ISO/IEC DP 10027 by providing an approach that will facilitate the standardization and management of the IRDS's Element Entity.

(U) In ACE Directive 80-57, SHAPE has recommended use of the Structured Analysis, Design, and Implementation of Information Systems (STRADIS) Methodology (AM 96-1-2 [Ref. 20] and AM 96-1-3 [Ref. 21]) as an an ACE formal life-cycle methodology for the implementation of all software projects.[9] It includes extensive activities related to data identification and analysis as part of its structured requirements analysis phase. STRADIS gives rules and guidance to be followed by management and implementors, and it gives recommendations on which methodologies should be used for the data analysis and database design phases. Specifically, STRADIS recommends [Ref. 5]:

- Use of the Yourdon data analysis technique (structured analysis, using data flow diagrams) [Ref. 22, 23, 24]
- Structured walkthroughs [Ref. 23, 25]

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9 (U) STRADIS was developed by the McDonnell Douglas Corporation. It is still proprietary and distribution in ACE is limited. The two-volume document has been revised to five volumes, but these have not yet been procured by SHAPE.

- Data normalization [Ref. 26]
- Automated support tools, including EXCELERATOR and DATA DESIGNER.

The STRADIS Project Data Dictionary is viewed as a repository for project metadata, the contents of which are to be compared with, and be expected to lead to eventual merging with, existing conceptual schema. The STRADIS also generates Project Entity-Relationship, Key-based, and Fully Attributed models that are considered prototype external schema for particular functional areas [Ref. 4].

2.3 Operational Rationale for Data Standardization

(U) Command and control of military forces is accomplished through information and is often supported by automation. The information flow required to support command and control has evolved over the years to a current system that is highly complex and often automated. Military leaders today are faced with unparalleled dynamics in the coalition warfare environment and an information level that is growing exponentially.

(U) The proliferation of automated office and tactical information systems has increased by varying factors in each nation's tactical formations. Similarly, the ACE ACCIS System Design and Integration Contract, War HQ's project, along with national plans for the tactical forces, will provide additional command and control information systems at the various echelons and headquarters within ACE. NATO has identified the need for these systems to be interoperable, and that information management is a required strategic and operational capability.

(U) The ability to effectively command and control forces on the battlefield and manage information resources requires that operational, procedural, and technical standards be agreed upon and implemented. The current Operational and Procedural standards identify less than half of the IERs required by tactical forces. The current methods of exchanging information [e.g., Message Text Formats (MTFs), voice, and formatted data] result in redundant transmission of information, misunderstanding, and inconsistency in interpretation, and they place an additional burden on limited tactical communications systems.

(U) Data standardization, including agreed operational definition of the information to be exchanged among the nations, is one of the key issues identified in the ATCCIS study. While the focus for ATCCIS is the next generation of tactical systems, this work must be started ***now***.

3. CONCEPT OF DATA

(U) Agreement is needed for a concept of data in order to provide an overall mechanism to express precise meanings and relationships of data to be exchanged in support of interoperability requirements. This chapter and Chapter 4 present fundamental concepts on data and data structure that are technical in nature. They are presented here for completeness, since much of the discussions in Chapters 6, 7, and 8 are based on these concepts.

3.1 Concept of Data

(U) In information systems, the basic unit of information is data. In this context, data refers to that unit that contains, but is not limited to, such things as: raw number, word(s) of text, codes, or graphical pixel representation. Formally, data may be defined as a representation of a person, place, thing, or concept in a pre-defined format or structure from which information can be derived.[10] The distinction between data and information is that, in and of itself, data has no meaning. Information has some contextual meaning attached to it, such that the use of that information can relate it to an aspect of the real world. As an example, the individual pixels (data) that make up a graphical image have the intended meaning (information) only when related to other pixels in a predefined way. When stored in manual or automated information systems, the actual occurrence of data is called a data value.

(U) The October 1988 AM 96-1-4 [Ref. 4] identifies a hierarchy of three fundamental data concepts:

- Data Element. This represents a named piece of data that is of interest to an organization. In order to make sense, it should be carefully and unambiguously defined, together with other characteristics or attributes that can help to express its content. A data element represents a master identification and description of the logical need for some item of data in an organization.
- Data Value. Represents a discreet "instance" of a data element and is what is of most interest to the end user--actual data upon which processing is undertaken and information is derived.

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10 (U) Data is defined in ISO 2382 (and in DP 7826) as "a representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means."

- Data Field. The smallest unit of data that has meaning in describing information; the smallest unit of named data.

(U) The logical connection between these concepts is as follows. The data element is the object of management within a data management and standardization program. Each data element is functionally described, together with a set of data values that are acceptable for each standardized data element that is adopted. Thus, each data element has a set of specified data values that an appropriate authority has deemed correct and of interest to the organization. The data field is the physical location of an instance of a data value within an operational database. This means that the only entities that may occupy a data field are the acceptable data values that have been deemed acceptable for the associated data element.

3.2 Categorization of Data Concepts

(U) Each of the three data concepts (data element, data value, and data field) can be categorized in two ways. The first is to distinguish qualitative data from quantitative data; this is known in ISO as data classification. The second categorization is by data type, in which there are traditionally six types: character string, bit string, float (or floating point), fixed-point, integer, and boolean (logical).

(U) The purpose of the two categories, data classification and data typing, is to provide a common framework for discussing data concepts and to ensure data is consistently treated and processed in software. Appendix A contains a further discussion of data classification and data types, including the definitions of each data type.

3.3 Data Element Concepts

(U) A generic element is a concept of data. It is distinguished from other concepts of data in that every generic element has a precise, well-defined set of those possible values that the generic element can take on. This means that, whenever a value is considered, it is always possible to determine whether that value is one permitted to be taken on by the generic element. As an example, the term "aircraft" is a concept of data that, standing alone, is not a generic element, since there is not a clear agreement as to the entire set of possible values. On the other hand, a two-character country code-of-world is a generic element commonly used in international commerce, where ISO has the responsibility for maintaining the agreed set of values.

(U) The term data element is used to identify those generic elements that have been assigned an organizational context, including an organizational description of what the data

element is. For example, the concept "date" is a generic element. A related data element "personnel information last modified date" has an organizational context. One of the difficult problems in data management is that the distinction between generic elements and data elements is vague and subject to interpretation.

(U) The concepts of generic element and data element introduced above are both constrained by needing an agreed set of acceptable values. This limitation is called a domain. The two types of domains, specific and general, are discussed in Appendix A, Section III.

3.4 Data Element Alias

(U) One of the problems in data element standardization is deciding how to handle previously defined data elements and implementing concepts in separate systems that are essentially the same data element. To standardize such a data element, a single data element representation is adopted as a standard, and the other occurrences are treated as data element aliases. A data element alias can differ from the standardized data element in the content of administrative, representational, or administrative attributes. Such attributes, as well as the concept of data element alias, are treated more fully in Chapter 4.

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4. STRUCTURE OF DATA

(U) The concepts discussed in this paper are taken from ANSI X3L8, Project 993T (this work is currently being drafted as an ISO DP by Working Group 4 of ISO/JTC1, SC 14). There are differences between these concepts and related concepts in ACE Manual 96-1-4. The ISO source was taken because it specifies further the concept of data element and its relationship to common sets of data values. This allows for the economy of scales in data standardization, and enhances the potential for reduced data redundancy and enhanced interoperability. ACE Manual 96-1-4 does not go far enough in defining these concepts.

(U) Additionally, through the use of a generic element, the structure of the data element can be standardized on a set of values as opposed to the manner in which the data are used. The latter approach (standardizing on use) introduces multiple occurrences into what might otherwise be a single data element and increases the potential for data redundancy. Indeed, when standardization on use occurs, multiple data elements can be created for a single data element since the name of the data element will reflect how those data are used, and not what they are. It must be emphasized that NATO standardization must occur on structure and NOT on use of a data element. (This is, in fact, the approach recommended by STC for ACE ACCIS: "...classification...is based on the principle of sorting data according to the type of information provided by their values...independently of their use." [Ref. 5]) The use of uniform structures eliminates the problem mentioned above, and improves communications and interoperability since there is a common data foundation. This foundation does not require systems or individuals to use a "translation" or "bridge" to interpret the contents of a data element or group of data elements, as in an IER.

4.1 Generic Element

(U) A generic element is a structure in data management that is used to specify a set of data values. Such a set can be used to support several data elements. A common set of values can be used by many different data elements that identify what different things are in relation to the real world or organizational environment. In other words, a generic element has no organizational reference associated with its structure. As an example, the data value for COUNTRY CODE OF WORLD "FR" has no context in and of itself--one can assume it stands for France--but there is no understanding of what it represents in an organizational reference. Contexts of such a generic element could be geographic, political, biographic,

or economic, as well as military. Thus, the code structure can be used in many contexts to form different data elements, while still conforming to a single agreed to structure.

(U) The generic element is specified by a collection of attributes that convey the technical information associated with a given generic element. These attributes are divided into three categories: administrative, relational, and representational. The administrative attributes address the descriptive type of information about the generic element. The most important attribute is the name of the generic element, which is unique and structured for identification purposes. (A full discussion of the naming of the generic element and data element is provided in Chapter 6.) The relational attributes give information about the generic element's connection to a controlling organization or agency. The representational attributes identify information about a common set of data values.

(U) Figure 1 illustrates the structure of a generic element. It shows that a generic element is composed of three types of attributes. One of these attributes will be its name. A proposed set of attributes for generic elements has been compiled from various national and international documents. These attributes are discussed in Chapter 7.

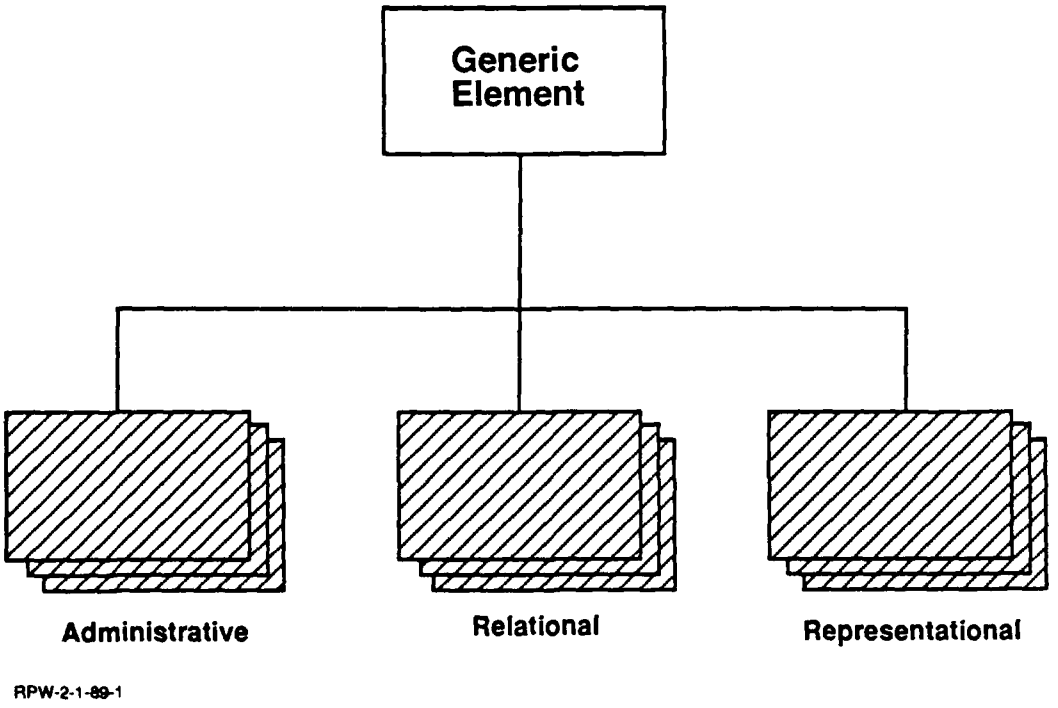

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Figure 1. (U) Generic Element Structure--A Collection of Attributes

(U) There are two constraints that need to be imposed on generic elements. These constraints are designed to assist in the standardization process and help maintain data integrity. These two constraints are:

(1) A generic element is unique to a single concept.

(2) A generic element's set of values will not be a subset of the values that have been enumerated by another generic element.

4.2 Data Element

(U) A data element, as previously defined, represents what an object is and determines the organizational context of a generic element. In other words, the structure specified in the generic element is formulated into a data element that identifies what that data element is in relation to the real world. This identification process is based on the "what it is" aspect of the data and not on "how I am going to use it." To continue with the "country code" example, if a data element were constructed to code the members of the ATCCIS Working Group Nations, "FR" could be used as data value for an ATCCIS Working Group Country Code-of-World. The generic element "Country Code-of-World" provides a common structure for country codes, and this instance of the data element identifies the particular members of a SHAPE body.

(U) The data element, like the generic element, is specified by a collection of attributes that convey technical information. When the data element is constructed, attributes are added to those of the generic element to form a complete identification and description of the data element. Data element attributes are also divided into three categories: administrative, relational, and representational. As before, the administrative attributes address the descriptive type of information about the data element, and the most important attribute is the name of the data element that is unique and structured for identification purposes. (A full discussion of the naming conventions for both the data element and generic element is provided in Chapter 6.)

(U) Figure 2 illustrates the structure of a data element. The figure shows that the data element includes all the attributes of the generic element to which it is associated. A proposed set of attributes for data elements has been compiled from various national and international documents. These attributes are discussed in Chapter 7.

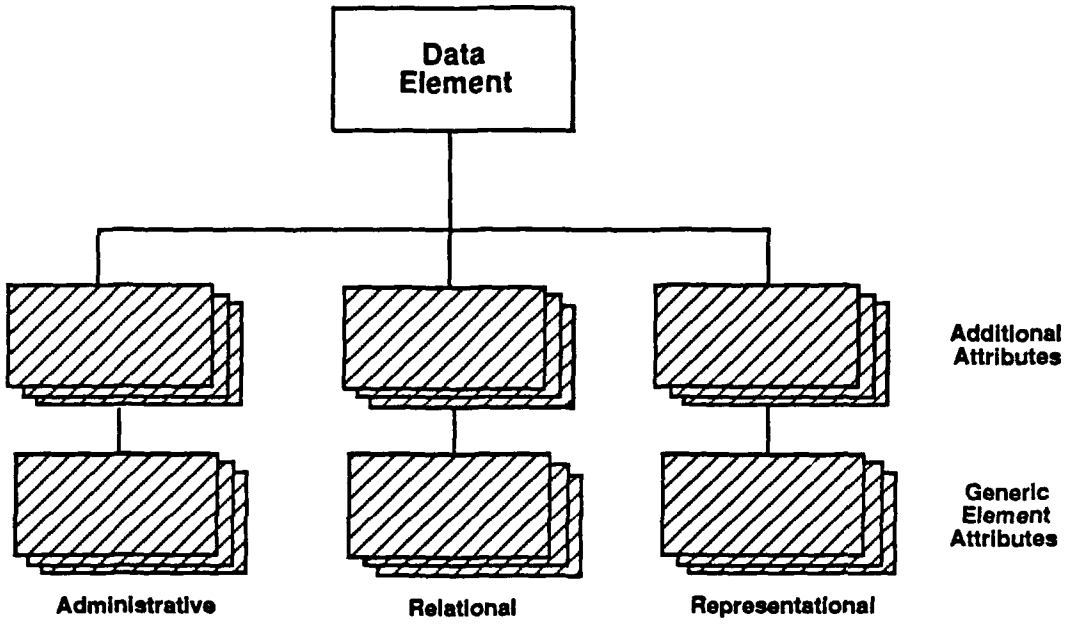

Figure 2. (U) Data Element

(U) There are a few constraints that need to be imposed on data elements. These constraints are designed to assist in the standardization process and help maintain data integrity. The constraints are:

- A data element's values will not be a subset of the values that have been enumerated by another data element.
- A data element's values will either be the same set or a subset of the generic element's values used to structure the data element.
- Data elements that are derived through chaining, computation, or calculation should be treated as any other data element.
- Multiple uses or "ordinal representations" of a data element will not be approved as separate standards. As an example, personnel data elements often capture the successive dates of the first, second, third, etc., occasion that the same award is presented to a soldier. These would be designated a single data element, which could be used several times, as opposed to creating three or more different data elements.

4.3 Data Element Alias

(U) A data element alias is used to identify data elements in use in a specific information system at a specific location. Data elements that are aliases differ from standard data elements in one or more of the attributes that have been specified for the standardized data element. Often, the differences will be in the name, the description, the set of data values, or other representational attributes. This mechanism is used to bridge current national data elements in fielded information systems to the proposed or actual CCIS data element standards, when and if differences exist. As information systems are redesigned, the use of the data element alias should be eliminated in order to facilitate cost reduction and facilitate communications in a coalition warfare environment.

(U) Figure 3 illustrates the structure of a data element alias. It shows that some of the attributes of the data element alias can differ from its associated data element. As an example of an alias, assume the US "UNIT IDENTIFICATION CODE" had a slightly different structure from the one specified in STANAG 5621; in this case,[11] the US data element "UNIT IDENTIFICATION CODE" would be made an alias to the NATO standard. In the alias specification the differences would be explicitly identified.

(U) A proposed set of attributes for the data element alias has been compiled from various national and international documents. These attributes are discussed in Chapter 7.

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11 (U) This example was taken from STANAG 5621, Appendix 3 to Annex A, UNCLASSIFIED.

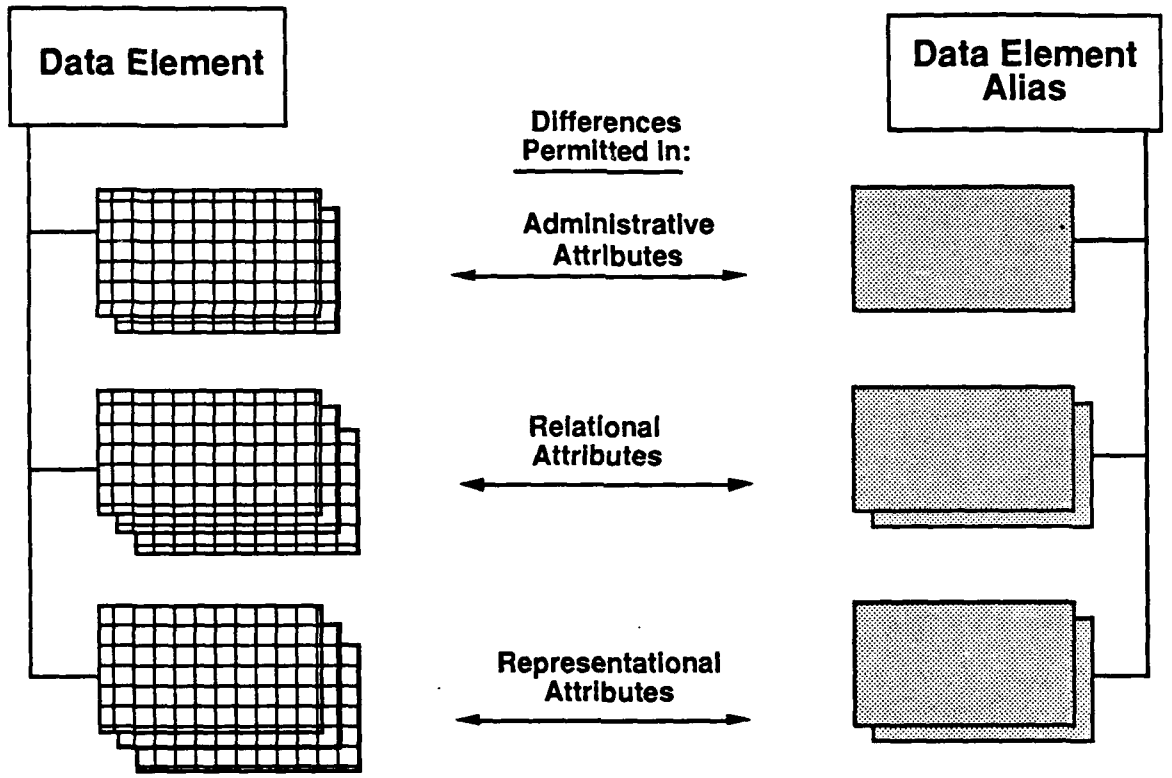

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Figure 3. (U) Data Element Alias

5. DATA MANAGEMENT GLOSSARY

(U) A glossary is needed to ensure a consistent definition is provided for all terms used in IERs, as well as in the specification of generic elements and data elements. This chapter provides background, purpose, and recommendations for a NATO data management glossary.

5.1 Background

(U) This chapter discusses NATO initiatives toward a glossary. An early concept, the Common Information Exchange Language (CIEL), originally developed by ADSIA [Ref. 27] and specified in an early draft of the NIPD [Ref. 28], was disapproved by the 15th ADSIA Plenary in 1986 [Ref. 29]. An overview of the now abandoned CIEL is provided as background; it is followed by a discussion of the NATO Common Information Exchange Glossary (CIEG), now known as the Glossary of Operational Terms (GLOT), which could be incorporated into AAP-6 or published separately as AAP-25.

5.2 Common Information Exchange Language (CIEL)

(U) The CIEL[12] was originally specified in an early draft of the NIMP to be that portion of the NATO Common Interface Standards (NCIS) that is procedural in nature. The three parts of the CIEL were a dictionary, a character-oriented message notation, and a bit-oriented message notation.

- The data element dictionary of CIEL was the one defined for NATO in ADatP-1 [Ref. 14] (no longer in effect; see Section 2.2.2).
- The character-oriented message notation already established for NATO and included in the CIEL is FORMETS as defined in ADatP-3 (STANAG 5500). FORMETS provides a formal notation for specifying both an abstract syntax (notations used in applications for information transfer that does not actually determine the representation to be used for data element values) and a concrete syntax (the transfer syntax derived from the abstract syntax in a particular application using encoding rules).
- The bit-oriented message notation for CIEL was the tactical data link language of ADatP-5, *NATO Data Link Message Standards (DALIMS)* [Ref. 30, now abandoned]. The function of this language was to provide a means to compile pictures and transmit command and control orders, weapons assignment, and

12 (U) The discussion of CIEL is taken from "CIEL Discussion Paper" [Ref. 24].

control orders in real time or near real time. DALIMS used data link message formats with bit encoding techniques. The goal of DALIMS was to provide a language that uses only standard bit fields common to all tactical data systems.

(U) There was no formal notation or language definition for DALIMS. Separate STANAGs[13] describe the generic message structure for each of the NATO digital data links, and this syntax differs among the various types of data links. ADatP-5 specified rules for the definition of bit fields; it also specified some standard bit fields, bit-field fillers, and required indices and cross-references for the fields that were used in DALIMS. Not all data links use the standard bit fields that were provided in ADatP-5, even for new development (e.g., Link-11).[14]

(U) The CIEL ideal concept was for one uniform data element dictionary, one abstract syntax for both character and bit-oriented message structures, and three or more different sets of encoding rules--one for character-oriented systems, one for Link-11 systems, and one for Link-16 systems. The data element dictionary was to be converted from its current form to a more structured form to facilitate (automatic) verification of its completeness and integrity. Alternates considered for the single abstract syntax were FORMETS, a modified version of FORMETS, ASN.1[15] (the preferred choice), or a subset of ASN.1. More than one set of encoding rules was envisioned because the single standard set of encoding rules for ASN.1 available today[16] dictates the inclusion of type and length information for each field and subfield each time a message is passed, whereas messages for current NATO data links contain very little information regarding data types and field lengths (most of the type and length data are fixed by the standard for the data link) to improve transmission efficiency.

(U) ASN.1 was the preferred choice of abstract syntax for ADatP-3 because ASN.1:

- Supports graphics and digitized voice, as well as the teletex characters that are supported by FORMETS.

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13 (U) For example, STANAGs 5501 (Link-1), 5503 (Link-3), 5504 (Link-4), 5507 (Link-7), 5510 (Link-10), 5511 (Link-11), 5514 (Link-14), and 5516 (Link 16).

14 (U) In some cases, the number of bits per field had been decreased in order to optimize bandwidth utilization [Ref. 27].

15 (U) Abstract Syntax Notation One, ISO 8824 [Ref. 31].

16 (U) Basic Encoding Rules for Abstract Syntax Notation One, ISO 8825 [Ref. 32].

- A full ASN.1 implementation would facilitate the use of commercially available products [since ASN.1 is the only approved ISO standard for open systems interconnection (OSI)].
- ASN.1 has all the power of data representation provided by FORMETS and greater flexibility in its structuring mechanism.
- The encoding rules are explicit and separately defined in ISO standards [the X.409 standard of the International Telegraph and Telephone Consultative Committee (CCITT) for abstract syntax is the same as ASN.1, but the encoding rules are included in the same standard].
- ASN.1 does not have input/output device-dependent limitations of FORMETS (e.g., separate lines may not exceed 69 characters, a field may not span a line, the group of fields in a columnar set may not exceed 69 characters); where such limitations are desired, they can be defined and enforced using data types.

The primary operational objection to ASN.1 encoding rules was that encoded ASN.1 messages are not human-readable. A review of this concern may soon take place.

5.3 Common Information Exchange Glossary (CIEG)

(U) The Common Information Exchange Glossary (CIEG) has been an ADSIA initiative to harmonize the definitions of terms used in the data element dictionaries of character- and bit-oriented (data link) messages. The need for such a common operational vocabulary was agreed to early in 1986 [Ref. 33], and the initial CIEG was produced six months later, based on STANAG 5511 (Link-11), STANAG 5516 (Link-16), and ADatP-3 (FORMETS). It included 1,176 items, one third without a definition and 44 with more than one definition [Ref. 34]. The CIEG is envisioned to contain terms and definitions applicable to both bit- and character-oriented systems [Ref. 35]. At one time, the CIEG was envisioned to be published and released by NATO's Military Agency for Standardization (MAS) as a separate document, namely AAP-25 (STANAG 5650) [Ref. 36]. Alternatively, it is possible that the work on the CIEG could be released as part of AAP-6.

(U) At a minimum, each entry in the Glossary will have a term, the agreed definition, and a reference to the context in which it is used. In addition, provision is made in the database for the GLOT to record source, reference number, broader term, narrower term, related term, synonym, non-peer synonym, status, and rationale.

(U) The Glossary will consist only of "operational" terms that "describe one or more parts of a function, or the subject(s) of that function in an operational activity."

Harmonization will be performed to ensure that each term relates (uniquely) to one definition, in the same context, irrespective of the community in which it is used. Multiple terms for the same object or activity will be harmonized. Units of measurement will be used only when necessary for an unambiguous definition, and acronyms will not be used, *in principle*, in the definitions.

(U) The Glossary should serve a number of purposes:

- Newcomers to the operational community who are supported by information systems will find the meaning and relationships of operational terms used in the information exchange to be common and preserved.
- Trained personnel will be able to check the meaning of an uncommon term or the meaning of a common term in an unusual context.
- ADSIA Working Groups will use the GLOT as a basis for procedural interoperability standardization.
- Common bit fields, representational terms, and conversion of terms based on the GLOT will be investigated for use in development of future data links and for consideration in the upgrade of existing systems [Ref. 36].

6. NAMING CONVENTION

(U) This section proposes a convention that can be used as a basis for naming generic elements and data elements in a structured manner. Such a convention is needed to ensure that those data elements that are standardized are not duplicates of other data elements and accurately reflect the intended data representation. The convention consists of syntax and a set of rules, both based on four types of words to be used in the names.

6.1 Introduction

(U) The purpose for using a naming convention is to provide a structured method by which standard names for generic elements and data elements can be developed. In this way, names developed in separate locations stand a good probability of having the same name or at least one that is very similar. This is necessary to eliminate the creation of duplicate data element standards (based on name) that have been developed for a single data concept. A naming convention or structured approach is needed to support the development of names to achieve this goal. Historically, the use of free-text name development has lead to multiple data element standards for a single concept. Without the control exercised through a naming convention, this trend will continue. The naming convention should, in addition to being a structured approach, result in a name that is pseudo-readable to the user. This means that even though the name conforms to a convention and may suffer some awkwardness in word flow, it must be readable to the user. The user must be able to derive the basic meaning of the data element by looking at the name. This type of feature is necessary to facilitate the use of data element standards for their intended purpose--the support of communication and interoperability.

(U) The proposed convention is based on standards emerging from the National Institute of Standards and Technology (NIST) [Ref. 19] that are expected to be offered to ISO in the near future. These conventions differ in many respects with the "OF-Language" convention recommended by SHAPE for data management and for use in ACE ACCIS [Ref. 5, 6]. The conventions recommended here are richer and are not based on a proprietary standard. The "OF-Language" alternative is discussed at the end of this Chapter and in Appendix D.

(U) Some of the guiding principles to be followed when naming conventions are developed and evaluated for adoption are [Ref. 19]:

- Clarity. Names are as clear and readable as possible. Ideally, they are immediately obvious to the casual user.
- Brevity within uniqueness. Names are as short as possible while still retaining meaning and uniqueness within the CCIS data structures (e.g., database). Conflicts between brevity and clarity are resolved in favor of clarity.
- Conformance to rules of syntax. Each name is in the proper format. Waivers, if granted, are used sparingly. The degree of specificity of format rules will drive the frequency of waiver requests.
- Context-freedom. Each entity is considered discretely from all others. The name references the logical structure, but is as independent as possible from the physical structure of the data and from other data entities. For example, the name of a data element derived from a report does not contain the name of or reference to the report. Relationships and other information documented in the data dictionary for an entry are not part of the name.

6.2 Definitions

(U) The are four types of words used in the structured naming of generic elements and data elements. These are defined below:

- Class Word (CW). A word used to specify the type of information contained in a set of data values.
- Modifier (M). A word that helps to refine, describe, or render a name unique for a data element, which is not designated a prime or class word. An architectural modifier (AM) is a special type of modifier for data elements that provides the logical connection between the data element and an organization's data architecture or data model.
- Prime Word (PW). A word used in a data element name that represents the data grouping to which the data element belongs.
- Qualifier (Q). A word used with a class word to further describe a characteristic of the information within a common set of data values.

6.3 Syntax for Naming Convention

(U) Structured names are needed for both generic elements and data elements. The syntax recommended in this Working Paper and described in this chapter is based on the U. S. National Institute of Standards and Technology (NIST) Special Publication 500-149 [Ref. 19]. The general syntax of the data element name is as follows:

M:PW:M:CW:Q

where M represents a modifier, PW represents a prime word, CW represents a class word, and Q represents a qualifier. Section 6.6 explains this naming convention in more detail, including the restrictions and numbers of each type of word that is permitted.

(U) The next two sections show how this syntax can be used to support the structure of generic elements and data elements with names that conform to the needs of an effective data management and standardization program.

6.4 Generic Element Name

(U) Each data element consists of the following: a structured name; information about administrative aspects of the element; a set of data values and structural information; and information about the element's relationships to other objects. A data element name is assigned organizational context through the use of a prime word and some modification words. The grouping of words is called a prime term and is discussed in Section 6.5.

(U) A structured name is given to a generic element based on a class word that represents a logical grouping of data values. The generic element name should accurately reflect the intent of a data value set and its associated structure. The generic element name further identifies the set of values that can be attached to a data element as in the case of a specific set (i.e., as in the country code example). Its name consists of an optional modifier, a class word, and up to two optional qualifiers. The general format is:

$$\begin{aligned} \text{GENERIC ELEMENT NAME} &= \text{(Modifier)} + \text{Class Word} + \text{(2) Qualifier(s)} \\ &= \text{M : CW : Q} \end{aligned}$$

(U) Figure 4 illustrates the structure of the generic element name. The following are examples of generic element names: DATE; DATE-TIME-GROUP; NAME.

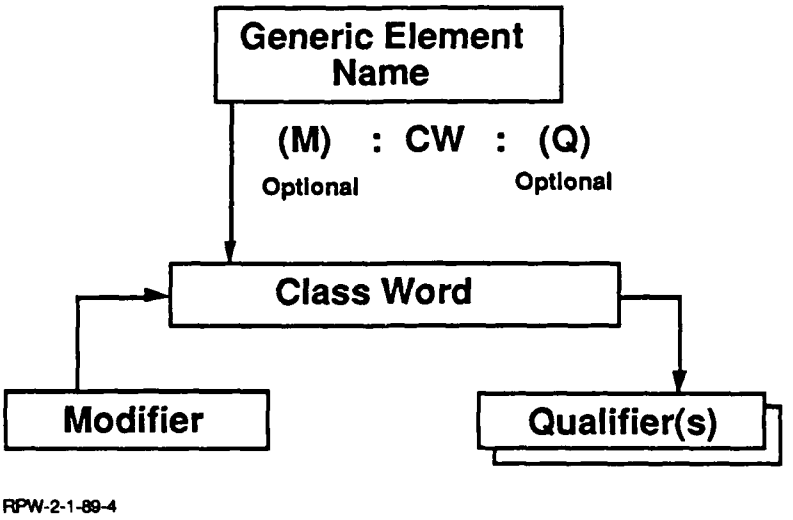

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Figure 4. (U) Generic Element Name

6.5 Data Element Name

(U) The structured name of a data element is composed of two components: a prime term and a generic element name. The prime term is composed of a prime word that may be further modified to construct a name that is representative of "what" the data element is purported to represent. Composition of the name takes the general format:

DATA ELEMENT NAME = AM : M : PW : M : CW : Q, where

PRIME TERM = AM : M : PW : M

GENERIC ELEMENT NAME = M : CW : Q

AM	=	Architectural Modifier--one required
M	=	Optional Modifier(s)- maximum of four in the Prime Term and one in the Generic Element Name
PW	=	Prime Word--one required
CW	=	Class Word--one required
Q	=	Optional Class Word Qualifier(s)--maximum of two.

(U) Figure 5 illustrates the structure of a data element name. An example of a data element name conforming to these conventions is:[17]

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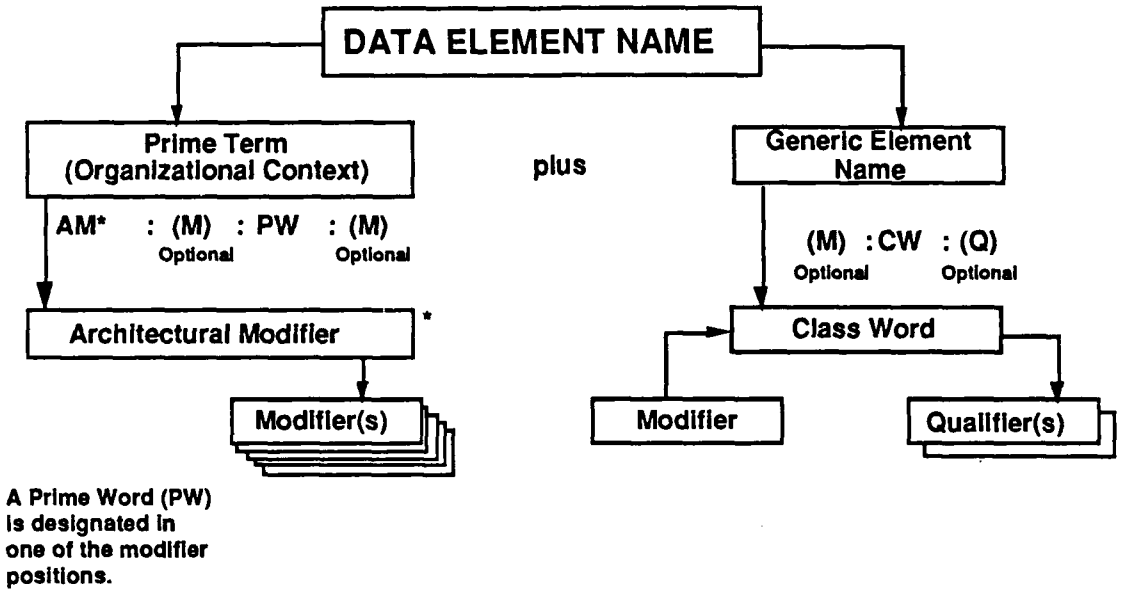
[17] (U) This example was taken from STANAG 5621, Appendix 3 to Annex A; however, most of the data element names cited in STANAG 5621 do not follow the conventions cited in this section.



UNCLASSIFIED

Figure 5. (U) Data Element Name

ALLIED COMMAND EUROPE UNIT IDENTIFICATION CODE

(U) A prime term (e.g., ALLIED COMMAND EUROPE UNIT IDENTIFICATION) identifies and represents the object or relationship between objects about which a organization wishes to maintain information. It has the form: AM:M:PW:M. Here, "ALLIED" is the architectural modifier, "COMMAND" and "EUROPE" are modifiers, "UNIT is the prime word, and "Identification" is a modifier. In general, an object is represented by a prime word, preceded by one architectural modifier and optional modifiers, and followed by additional optional modifiers that further define what the object is in relation to the organization. In the prime term:

- The prime word (e.g., UNIT) should be positioned in front of the class word (i.e., in front of the generic element name) and within the prime term.
- The architectural modifier (e.g., ALLIED) provides the logical connection between the data element and an organization's data architecture or data model. The architectural modifier should be the first word in the data element name and may also serve as the prime word for the data element name if so desired.

Architectural modifiers should appear on the prime word list; however, not all prime words are architectural modifiers.

(U) The generic element name (e.g., CODE) identifies a grouping of similar data values, which has been classified for use with a data element.

6.6 Rules for Naming Convention

(U) The naming rules apply to the construction of standard element (generic element or data element) names for CCIS information exchange requirements. The rules should also be applied to reconstruction of names of existing data elements for registration in an appropriate repository or encyclopedia. A restructured existing data element name not registered as an approved CCIS data element should be carried as an alias. Thus, when information sharing and compatibility are required across two or more CCISs, data element names will adhere to the same principles and structural rules. In this way, common data elements can be identified. There should be no alteration to the principles and structural rules that are adopted, so that a high degree of standardization can be achieved and data redundancy can be eliminated.

(U) The following rules apply to the naming and formulation of generic element or data element names:

- Rule 1: Each generic element name will contain one and only one class word.

  Comment: By restricting the generic element name to one class word, the standard element is formulated to describe only one type of information collected about an object.

- Rule 2: Class words will be reserved (i.e., they will not be used as modifiers, qualifiers, or prime terms).

- Rule 3: Each data element name will contain one prime word and describe only one concept.

  Comment: By requiring a data element name to have one prime word, the data element is formulated to explicitly describe only one concept.

- Rule 4: The sequence of words in a data element name will be in the following format: Modifier(s) (if required), Prime Word, Modifier(s) (if required), Class Word, Qualifier(s) (if required).

  Comment: Optionally, a class of modifiers, called architectural modifiers, may be defined to provide a logical connection between a data element and a data or information model. When used, these must be the first modifier in the prime term.

- Rule 5: Each data element name will include its related generic element name.

- Rule 6: Plurals of class words or prime words are not permitted.

  Comment: Removing plurals from data element names encourages the designer to think in terms of primitive concepts and increases the possibility that two people will develop the same name to describe identical concepts.

- Rule 7: Modifiers and qualifiers will be used to fully describe a standard element (five modifiers per prime word and one modifier plus two qualifiers per class word).

  Comment: An architectural modifier is counted as one of the modifiers for the prime term.

- Rule 8: Word order of commonly used terms will be preserved in data element alias names (e.g., Port of Debarkation, Ministry of Defence).

- Rule 9: A unit of measure suffix will be applied to the names of all elements that describe a numeric quantity (e.g., Volume-in-Litres).

- Rule 10: No abbreviations or acronyms are permitted in a standard element name.

  Comment: Abbreviations and acronyms detract from the clarity of a standard element name.

- Rule 11: Only alphabetic characters (A-Z, a-z) are permitted in a standard element name with two exceptions.

  (1) A hyphen may be used to connect the words in a prime term or generic element name.

  (2) A number may be used when it is part of a descriptive name (e.g., M109A3 Howitzer).

  Comment: By permitting only alphabetic characters, standard element developers are encouraged to describe standard element names in terms of what the data is and not how it is stored or used. This rule also improves the probability that different people will develop the same name for identical standard elements.

- Rule 12: Names of organization, computer, or information systems, directives, forms, screens, or reports are not permitted in standard element names.

- Rule 13: Titles of blocks, rows, or columns of screens, reports, or listings are not permitted in standard element names unless those titles satisfy Rules 1-11.

6.7 Relation of Recommended Naming Convention to Other Standards

(U) The Information Resource Dictionary System (IRDS) [Ref. 37] is an emerging standard for formally describing data. The structure for assigning names in IRDS provides for three different kinds of names for data entities, and the convention recommended for ATCCIS is consistent with IRDS. The IRDS structure supports:

- A single Access-Name, serving as the primary, unique identifier of the data entity. A data dictionary entity has only one Access-Name. The convention recommended in this Working Paper for ATCCIS provides for the Access-Name as an attribute of each data element, "INFORMATION DATA ELEMENT MNEMONIC ABBREVIATION" (see Appendix E, Section 2.1).
- An optional Descriptive-Name, normally longer and serving the same function as the Access-Name. The Descriptive-Name corresponds to the data element name defined in this Chapter for ATCCIS.
- Optional Alternate-Names, providing functional attributes of the entity; they are not unique and serve as aliases. The concept of data element alias provides this function in the convention recommended for ATCCIS.

(U) Several options are defined in the NIST recommendation [Ref. 19, Section 5.1] *for naming conventions.* Two of these options are included in the convention described in this chapter and recommended for ATCCIS. The remaining option was omitted, since it puts both the class word and prime word as the the leading terms for a data element and is therefore the least readable of the three options. Note that NIST convention applies to the term "Access-Name"; this convention has been extended and applied to both generic elements and data elements.

(U) In its discussion of data terminology,[18] AM 96-1-4 discusses only one naming convention, the so-called "OF-Language," and recommends it for adaption, as appropriate, in ACE. Appendix D contains a short description and some examples for the use of the "OF-Language" naming convention.

(U) The use of the "OF-Language" naming conventions to support the naming of data elements has three major faults. These restrictions render its use undesirable. These faults are:

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[18] (U) "Data Terminology," Annex A, AM 96-1-4 [Ref. 6], Section 1.L.

- First, the "OF-Language" is based on the premise that standardization is to be accomplished on the use of data elements vice the structure of the data element. In previous discussions it has been shown that standardization based on use is counterproductive to the aim of interoperability. The synonymic and homonymic issues that arise based on data usage, create a potential redundancy and incompatibility of data that will not support the relatively free flow of information implied in the NIPD definition of Degree 5 or 6 interoperability.
- Second, the "OF-Language" is a psuedo-symbolic representation for a data element name. This makes the syntax difficult for the average user to read and comprehend. The more text oriented the name development, the greater is the potential for successful implementation. Data standardization for interoperability, or any purpose for that matter, must be functionally based. This means the functional experts must decide on the material content and naming of the data elements. Only in this way will the required meaning be placed in the correct context to support efficient and effective use of Information Exchange Requirements.
- Lastly, the "OF-Language" is perceived as a proprietary-based convention due to its conceptualization and development by the IBM Corporation to support IBM hardware. This proprietary aspect of the language makes it highly suspect in an ATCCIS environment that is seeking to identify and develop non-proprietary standards to answer near-term and future command and control issues.

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7. ATTRIBUTE LIST

(U) As discussed earlier in the paper, within the concept of data, each of the three elements identified to support data management--generic element, data element, and data element alias--is a collection of attributes. These attributes qualify or characterize the distinct features of each element. In order to achieve data management in the environment, a set of attributes will have to be selected as a minimum set, on which to base such activities. This selected set will enable the operators of ATCCIS conformant systems to collectively identify, store, communicate, and manipulate data from a common point of reference. This does not imply that the physical storage in national systems will have to change based on these attributes; rather, to facilitate the communication of IERs (from the data element perspective), a common point of reference must be established.

(U) The attribute list provided in Appendix E has been prepared as a suggested starting set. Each attribute has been named in accordance with the naming conventions proposed earlier in the paper and is accompanied by a definition. To achieve data management, such a list will have to be compiled, along with definitions and more technical details of what the physical manifestation of each attribute will look like for storage purposes.

(U) The attributes have been broken down by element and, within each element, by those that are administrative, relational, and representational. See Appendix E for the listing.

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8. DATA MANAGEMENT POLICY AND PROCEDURES

(U) This is a proposal for addressing the requirements in CCIS data management in the area of policy and procedures.

8.1 Introduction

(U) This chapter contains an approach for the procedural standards for CCIS data management, including development, documentation, review, approval, implementation, and archiving for generic elements, data elements, and data element aliases. The term "standard element" is used when more of these three types of elements is being referenced and to simplify discussion.

(U) ACE Manual 96-1-4 describes in some detail the responsibilities of CCIS data administrators and database administrators. The other personnel referenced below are: information class proponent, data encyclopedia administrator, standard element developer, and ACE (ATCCIS) data manager. The roles of these personnel are described in the sections that follow.

8.2 Standardization Procedures for Data Elements and Other Standard Elements

8.2.1 Identifying Data Element Requirements

(U) Data elements and other standard elements required to support CCIS applications are identified during the life cycle phases of an information system. The identification of standard elements should be done in the early phases of a system's life cycle. The system developer or the system's functional proponent should compare these standard elements to existing standard elements in a CCIS data encyclopedia to determine if existing standard elements can satisfy the data requirement of the application. When standard elements are found that meet the requirement, documentation from the encyclopedia should be incorporated into systems design documentation (e.g., data requirements document). If no standard element is found or a change is required to an existing standard element, the standardization process must be initiated.

8.2.2 Data Standards Considerations for Information Systems

(U) The following considerations apply throughout the life cycle of any information system:

(1) Data Documentation. A CCIS data encyclopedia should be used as a source for producing data documentation for information system design documents. Using a CCIS data encyclopedia ensures that data documentation remains consistent CCIS-wide in whatever information system it may be used.

(2) Reviews. Organizational data administrators should participate in design reviews, technical walkthroughs, and CCIS design tests to ensure that standard elements are actually being incorporated into the technical design. Organizational data administrators and database administrators will participate in software qualifications tests to ensure that data standards are being used as intended.

(3) Application Program Development Support. Organizational data administrators and database administrators should provide documentation and advisory services that assist with software development efforts to ensure that data are independent of the application programs being developed. Specifically, organizational level data administrators and organizational level database administrators should:

(a) Support the development effort by using a CCIS data encyclopedia to locate or generate standard elements for use in command and control information systems.

(b) Encourage system developers to use data starvation techniques to delay binding time[19] between application program and databases. Data starvation is the avoidance of explicitly declaring data structure definitions within the application program. The program is coded to rely on dictionary look-ups at execution time. The longer the binding time is delayed, the more predisposed the software will be to adapt to changes in the data.

(c) Assist standard element developers in installing standard elements, element changes, and version updates.

(d) Use a CCIS data encyclopedia to manage change and version updates, as well as make new data representations available to users, in support of application program testing.

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19 (U) In this context, binding time refers to the time in the system development process that the system designers are provided detailed information about the databases to be incorporated into the system. Until the binding time is reached, the developer must retain a high degree of independence between the application software and the attributes of the data to be used.

8.2.3 Status of Standard Elements

(U) Each standard element will have a standardization status: candidate element, approved element, installed element, or archived element. Each status marks the progress of the element through the data standardization process. The possible standardization status states for a standard element are:

(1) Candidate Element. This is the status assigned to a data requirement that has been identified, defined, and submitted to the appropriate organizational data administrator for review. A candidate element can include a generic element, a data element, a data element alias, or a change to an existing standard element.

(2) Approved Element. Candidate elements that have passed functional and technical reviews are upgraded to approved elements. Data values based on approved elements may be used for development. The Information Class Proponent must assign and coordinate organizations authorized to supply data values, define access requirements, and specify a CCIS-wide installation date for each approved element. Once data elements have an installation date, there can be no further changes to the element.

(3) Installed Element. On the assigned installation date, an approved element is upgraded to an installed element. Databases will have been modified to accommodate the actual data values based on the newly installed element, and affected information systems must then operate using updated versions of the databases. Organizations authorized to supply data values will commence their responsibilities for entering and maintaining the data in the databases required to run in accordance with the installed element. After the installation date is assigned, the standard element will be used.

(4) Archived Element. Installed elements become archived elements when they no longer support a data requirement. The archived element and its associated attributes will be retained in the CCIS data encyclopedia for a period of time required by NATO policy or as established by the CCIS data encyclopedia administrator. These retained standard elements will be used to assist with compiling or recovering information that spans several versions of the CCIS data encyclopedia.

(5) Non-Standard Element. Those information systems and application programs not using standard elements will bear the cost of data conversion for any necessary transmittal to standard information systems and databases. Systems using non-standard elements must be modified or bridged to the standard. The non-standard element will be registered in the CCIS data encyclopedia as an alias to the appropriate current standard element.

8.3 Life Cycle for Standard Elements

(U) To control standard elements, organizational data administrators must actively incorporate the disciplines of life cycle management. The standard element life cycle reflects four phases necessary to define, approve, implement, assess, and review standard elements.

8.3.1 Phase 1--Element Requirements Definition

(U) Detailed data requirements definition occurs during the definition and design phases for information systems development life cycle. The following are the major activities for Phase 1:

(1) Standard Element Development. If a standard element does not exist, the required set of attributes for the new element must be documented and submitted for standardization to the information class proponent. The organizational data administrator assists the requirements developer in reviewing the current inventory of CCIS standard elements to determine whether or not a standard element exists that suits a specific information requirement. In order to determine the specific set of attributes to document, standard element developers must consider the following possibilities:

(a) For a candidate generic element: When the data requirement cannot be satisfied by an existing generic element, the Standard Element Developer must develop a candidate generic element that will satisfy the requirement. A candidate generic element may represent a change to an existing generic element or an entirely new generic element.

(b) For a candidate data element. After searching the current inventory of CCIS standard elements and no data element is found that meets a particular information requirement, the requirements developer must submit documentation for a candidate data element. This documentation will contain the information necessary to satisfy the attributes for the element.

(2) System Control Data. Data elements will not be standardized if they are designed only to make system inputs or outputs more appealing, are primarily syntax or semantics related, or if they have no particular significance to CCIS missions and goals. Standard element developers will not categorize data elements as system control data in order to avoid standardization requirements.

(3) Candidate Element Documentation Submission

(a) Organizational data administrators will review standard element documentation from requirements developers in their area of responsibility

and in accordance with guidance from their chain of command. These developers will submit elements for coordination and review in order to begin the review and approval phase (Phase 2). At this time the status of the element changes from proposed to candidate. The elements are submitted through the standard element approval channel. Review is facilitated by use of a CCIS data encyclopedia.

(b) To ensure expeditious and timely approval of data elements for use, candidate elements will adhere to guidance provided ADSIA.

8.3.2 Phase 2--Review and Approval for Candidate Elements

(U) The following are the major activities for Phase 2:

(1) Organizational Data Administrator Review. The organizational data administrators will review the documentation submitted on candidate elements to ensure that the documentation meets documentation standards prescribed in ADSIA guidance. As part of the review and validation process, organizational data administrators will:

(a) Facilitate the coordination of candidate elements at their level of command to ensure proper staffing with the functional and technical personnel in their area of responsibility. The CCIS data encyclopedia administrator will provide advice to the organizational data administrator on technical considerations as appropriate.

(b) Facilitate the coordination of candidate elements with subject matter experts who will validate the functionality of the candidate standard element.

(c) Coordinate with the likely users of the candidate standard element.

(d) Compare a candidate standard element to existing standard elements to ensure it does not already exist.

(e) Review the collection of attributes completed by the requirements developer to confirm the completeness of the information submitted.

(f) Verify that the candidate element is assigned to the appropriate information class.

(g) Forward recommended candidate element to the NATO Information Class Proponent.

(2) NATO Information Class Proponent Functional Review:

(a) The NATO Information Class Proponent should ensure consistency of elements among related development projects and with existing standard elements. This includes resolving differences in documentation for the

same candidate element and staffing with interested users the positions taken.

(b) When reviewing candidate standard elements, NATO Information Class Proponents will consider STANAGs, directives, and associated regulations, along with security classification and operational security.

(c) To effectively eliminate the possibility of redundancy or inconsistency, the NATO information class proponent will ensure that naming conventions as prescribed in Chapter 6 are properly applied. Each data definition describes what the data element is, represents only one concept, and supports both the element name and the set of data values. The NATO information class proponent will coordinate with the CCIS data encyclopedia administrator to receive and resolve the results of the technical review.

(d) To ensure that candidate standard elements support the CCIS missions and goals and that they are more generally applicable across the CCISs, the NATO information class proponent will review the candidate to:

- Verify that the candidate element does not duplicate an existing standard element.
- Verify the regulation, publication, bulletin, or other document that authorizes use of the candidate standard element, when applicable.
- Verify that the candidate standard element supports information requirements from a CCIS-wide perspective.
- Determine the criteria for accessing the data. Access ranges from "available to all" to "private." Access is determined by NATO or other policy, functional need, and security requirements.
- Designate the office(s) or person(s) who are authorized to enter data values into a data element within a database or information system.
- Designate the office or person who will be the functional expert for defining, reviewing, and updating the candidate standard element and its attributes.
- Determine whether the requested access privilege conflicts with previously established access privileges.
- Resolve conflicts in usage and responsibility where necessary.

(3) CCIS Data Encyclopedia Administrator Technical Review. The CCIS data encyclopedia administrator will conduct a concurrent technical review of the candidate element for its adherence to CCIS policy and guidance. This includes such considerations as reviewing field types and sizes; the CCIS-wide

impact of adopting the candidate standard element; the proper use of naming conventions; and whether the candidate standard element name is a proper reflection of the definition. If a candidate standard element fails the technical review, the encyclopedia administrator will make the necessary recommendations to the NATO information class proponent to bring the candidate standard element into technical compliance. As a minimum the technical review will look at the following aspects of the candidate element:

(a) Conformance to appropriate provisions of NATO and other applicable international standards

(b) Proper application of naming conventions, as prescribed in Chapter 6

(c) Cohesive data definitions (i.e., the data definition does not represent more than one concept and supports both the standard element name and the set of data values).

(4) NATO Information Class Proponent Approval. The NATO information class proponent will approve or disapprove a candidate standard element pending the final technical review by the CCIS encyclopedia administrator. If the candidate element passes the reviews, the NATO information class proponent will approve it as an approved standard element.

(5) Adjudication. The ACE (ATCCIS) Data Manager resolves disputes among NATO information class proponents for ATCCIS and the CCIS data encyclopedia administrator concerning candidate standard element approval, installation, and archiving. When other resolution efforts fail during the review and approval phase, the ACE (ATCCIS) Data Manager performs the role of arbitrator. The ACE (ATCCIS) Data Manager will review recommendations, consider any grievances, and render final decisions.

8.3.3 Phase 3--Implementation of Approved Elements

(U) Once candidate standard elements become approved elements, the CCIS data encyclopedia administrator will identify maintenance that needs to be performed on existing data structures and specify how updated values for the approved standard element are to be distributed.

(U) In those CCIS databases and information systems that require a direct data exchange, an installation date will be specified for each approved standard element. This is the date after which the approved standard element becomes installed and use of a standard element is mandatory in partitioned and replicated databases, applications, and reports. It is also the date by which implemented ATCCIS conformant databases must have been changed or the required aliases have been entered into the encyclopedia. Where the change

applies to a manual portion of a CCIS with no automated interface, the new standard element will be phased in as the current shelf stock of forms is depleted. Forms will be redesigned to use the installed standard element.

8.3.4 Phase 4--Assessment and Review of Standard Elements

(U) During assessment, organizational data administrators will conduct audits of data being maintained in databases and information systems to ensure data quality and track the usage of the data to determine whether collection and maintenance of the data is considered to be worth the cost. Assessment results will be made available to NATO information class proponents and users for use in performing data management responsibilities. The following are the major activities for Phase 4:

(1) Verification. After the installation date of an approved standard element, the CCIS data encyclopedia administrator will verify that the standard element has been physically added to the databases and information systems that are new or have been modified, and which are required to run CCIS. The results of the installation review will be provided to the system development team involved. Problems encountered will be addressed based on the criticality and priority of each problem.

(2) Monitoring. Organizational data administrators will maintain an ongoing effort to measure and evaluate the use of data by databases and ATCCIS Applications, and to monitor the environmental changes affecting performance. Measurements established for those standard elements of the databases required to run the CCIS that are deemed critical (e.g., response time, line traffic, mean time-to-failure, mean time-to-recover, adherence to procedures) will be monitored and evaluated regularly, and historical information kept so that trends can be observed and, whenever possible, problems can be avoided or minimized.

(3) Evaluation. Organizational data administrators will determine if data is being exchanged across databases, ATCCIS Applications, and functional lines. Projected activity in databases and information systems will be compared to actual activity. All recovery, security, and synchronization procedures and processes will be monitored to ensure that they actually function as designed.

(4) Standard Element Archiving. The CCIS data encyclopedia administrator recommends to the ACE (ATCCIS) Data Manager the archiving of any standard element that is no longer needed and whose maintenance and management cost may exceed its utility. Consideration must be given to use of the standard element in manual systems, forms, reports, messages, and supporting publications. Standard elements nominated and approved for

archiving will be maintained as archived standard elements in the CCIS data encyclopedia for a period of time as prescribed by NATO. Recommendations for archiving will follow the information management approval channel as specified in the candidate standard element approval phase.

8.4 Enforcement of Standard Elements

(U) Standard element enforcement procedures should be worked out by agreement within the NATO nations. The exact specification of these procedures, as well as the policy they support, are the responsibility of the NATO nations that participate within ATCCIS. However, to be effective, a data management and standardization effort must have the responsibility and authority to accomplish the task. The enforcement of standards is critical to the success of the standardization effort. Due to the sensitive nature of these types of rule-penalty relationships and their importance, none will be proposed here and their determination will be left to the appropriate NATO body.

8.5 Exemptions and Waivers

(U) Exemptions and waivers will be granted only in exceptional situations. The overall success of the data management program depends on how effectively these exemptions and waivers are handled. Neither exemptions nor waivers will be granted for new databases or information systems merely because nonstandard data are currently being used in databases and information systems with which the new database or information system must interface. Neither exemptions nor waivers are permanent. Procedures for exemptions and waivers are as follows:

(1) Exemptions are approved where compliance with a standard element is either impossible or extremely impractical. Exemptions are re-evaluated by the ACE (ATCCIS) Data Manager at least biannually.

(2) Waivers are approved for a specific period of time and are automatically revoked at the end of that time period. The maximum time period that can be specified for a waiver is 90 days (or some other period agreed to). Waivers may be granted in areas where previously established priorities preclude compliance with a standard element within the time frame specified.

(3) Requests for exemptions and waivers will be submitted in writing through data management channels to the CCIS data encyclopedia administrator and must contain complete supporting information that will assist in evaluating requests. The CCIS data encyclopedia administrator will evaluate the request, recommend to the ACE (ATCCIS) Data Manager approval or denial of exemptions and waivers, and advise the requester of exemption and waiver

decisions. Requests for back-to-back waivers will be forwarded for decision. The written request must contain the following information:

(a) Type of request (i.e., exemption or waiver)

(b) Name of the CCIS database or application for which the request is written

(c) Names of the standard elements for which the waiver is requested

(d) Names of the nonstandard elements currently being used

(e) Reasons for not implementing the standard elements.

(4) The CCIS data encyclopedia administrator will maintain records to identify all exemption and waiver requests as a suspense control for re-evaluating exemptions and assuring that compliance with standard elements is achieved.

(5) Organizational data administrators will receive a copy of each exemption and waiver granted.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 Conclusions

(U) The conclusions of this Working Paper are as follows:

(1) To achieve interoperability, data standardization and management must be accomplished through an integrated approach.

(2) Discussions of data management issues have not led to a NATO-wide policy. A data management policy is needed, and this need has been recognized by ADSIA and other NATO bodies. The ISWG has been asked by ADSIA to provide recommendations on data management.

(3) A NATO glossary of military/operational terms is needed for information exchange; it must go beyond the current approach being used in the development of AAP-25.

(4) Development of standards by ISO/IEC and other standards bodies for data representation, syntax, encoding, and exchange needs to be monitored by NATO agencies. Appropriate bodies of TSGCEE, ADSIA, and NACISA need to assess how well the civil standards meet military requirements for data management and agree on a policy. Further analysis and a decision on message syntax requirements and standardization options (e.g., ASN.1, FORMETS) is needed.

(5) A NATO Data Element Naming Convention is needed.

(6) A NATO Data Element Attribute List is needed to characterize the distinct features of data elements and other data concepts.

(7) The NATO data management policy needs to be applied to the specification of data elements to be used for developing and validating IERs.

9.2 Recommendations

(U) The following recommendations are provided for consideration by the appropriate NATO - SHAPE bodies:

(1) A consistent and integrated NATO-wide data management policy should be developed, approved, and promulgated by the NACISC.

(2) The nations, NATO, and SHAPE should monitor ISO/IEC development of standards for data representation, syntax, encoding, and exchange. Appropriate bodies of TSGCEE, ADSIA, and NACISA should assess how well the civil standards meet military requirements for data management and make recommendations.

(3) A NATO-wide glossary of military/operational terms should be developed. ACE, the other Major NATO Commands (MNCs), and the nations should press urgently for an authoritative statement by NATO.

(4) A NATO-wide Data Element Naming Convention should be developed. The naming convention provided in Chapter 6 of this Working Paper should be adopted as a starting point for use with data elements and other data concepts. It should be modified as necessary and used in ACE and NATO.

(5) A NATO-wide Data Element Attribute List should be developed. The list provided in Appendix E should be used as a starting point.

(6) The recommended actions should commence as soon as possible for the specification of data elements to be used for developing and validating IERs.

APPENDIX A

CATEGORIZATION OF DATA CONCEPTS

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CATEGORIZATION OF DATA CONCEPTS

(U) Each of the three data concepts (data element, data value, and data field) can be categorized in two ways. The first is to distinguish qualitative data from quantitative data; this is known in ISO as data classification. The second categorization is by data type, in which there are traditionally six types: character string, bit string, float (or floating point), fixed-point, integer, and boolean (logical).

(U) The purpose of these two categories is to provide a common framework for discussing data concepts and to ensure data are consistently treated and processed in software.

I. CLASSIFICATION OF DATA

(U) Each data concept may be classified as quantitative or qualitative (descriptive). Quantitative data concepts have sets of assigned values that answer the question "How much?"

(U) Data values can be divided into two types (see Figure 1): qualitative data (sometimes referred to as data items) and quantitative data. A data value, either qualitative data or quantitative data, represents the content of a data element--a piece of data that has been defined within the context of an organization.

(U) Qualitative data are a non-quantitative combination of characters or binary string that represent a qualitative aspect of a person, place, thing, activity, or concept. For example, a person's last name can be a data item. Operations such as compare, concatenate, and logical AND/OR can be performed on qualitative data, where appropriate. Qualitative data are of three types: literal data, data code, and image data.

- Literal Data. Literal data is a narrative or human-readable representation of a data element. The occurrence of the data element--a data value--requires no translation before use. An example would be the words of text as they appear in this paragraph.
- Data Code. A data code is a number, letter, character, symbol, or combination of them that is used to represent literal data. An example is the two-character alphabetic combination that NATO uses to identify the NATO nations: FR--France, GE--Germany, UK--United Kingdom, etc.

- Image Data. Image data is normally a bit-string representing the results of video, graphic, or photographic processing, transfer, or storage.

(U) Quantitative data are numerical expressions such as: 4, -3.1, and 5.3*10**-3. Arithmetic operations are performed on quantitative data.

II. DATA TYPES

(U) Six data types are identified below. The first three definitions are primitive types recognized by ASN.1; all but the integer type are recognized by the Information Resource Dictionary System (IRDS) [Ref. 37].

- Integer. The positive and negative whole numbers, including zero; the range is unbounded.
- Boolean. A true or false value.
- Bit-string. An ordered set of zero or more bits (i.e., 0 or 1) of unbounded length; the range is effectively unbounded.
- Character-string. An ordered set of zero or more characters.[1]
- Float. A number representation system in which each number, as represented by a pair of numerals, equals one of those numerals times a power of an implicit fixed positive integer base where the power is equal to the implicit base raised to the exponent represented by the other number (e.g., in BASE10, 545 is 5.45*10**2 in common notation or 545+02 in standard floating point representation).[2]
- Fixed-point. A radix (point) numeration representation in which the radix point is implicitly fixed in the series of digit places by some convention upon which agreement has been reached (i.e., the appearance of the radix or "decimal" point can be implicit or explicitly shown). For example, a five-significant-place decimal representation of pi is 3.1416 or 31416, where the decimal place of the latter is fixed by agreement.

III. DOMAINS

(U) The concepts of generic element and data element, discussed in Section 3.3 of the main body of this Working Paper, are both constrained by needing an agreed set of

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1 (U) The ISO definition of "character": a member of a set of elements upon which agreement has been reached and that is used for the organization, control, or representation of data [Ref. 11].

2 (U) *Vocabulary for Information Processing*, X3.12-1970, ANSI, December 1970.

acceptable values. This limitation is called a domain or, more precisely, a domain set.[3] When the domain set of a data element is specified, the domain set can be divided into two types: specific and general. These types are discussed below.

A. Specific Domain

(U) A specific domain has a definition together with a discrete, finite set of acceptable values. For a specific domain, one can always explicitly compile a complete list of these acceptable values. As an example, the specific domain set for the data element "NATO country code-of-world" is {BE, CA, DA, FR, GE, GR, IC, IT, LU, NL, NO, PO, SP, TU, UK, US}. Codes or identifiers are usually specified by such a domain. Once an agreed to domain has been established, at the generic element level, data elements standardized on that domain must use the whole domain set or a subset of that domain. As in this example, the 16 codes in the data element are a subset of the domain set specified in the generic element "country code-of-world."

B. General Domain

(U) A general domain (set) specifies its limitations in terms of a general definition or a range of acceptable values. In DP 7826 [Ref. 11] the following example is given by ISO for the domain of the generic element "code":

> Coded representations shall consist of up to 35 characters that uniquely represent a complete name of a data (value), selected from a data (value) set of a data element, within a coding scheme. Unless otherwise specified, the coded representation shall use the following subset of ISO 646 International Reference Version (IRV): (a) the letters A to Z single case only; (b) the digits 0 to 9; (c) space; (d) hyphen; (e) point; (f) solidus,[4] [and] (g) colon.

This is a an example of a general domain.

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3 (U) The use of the term "domain" here differs from its use in WP 24.

4 (U) Solidus is sometimes called "backslash" and represented as "\".

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APPENDIX B

LIST OF CLASS WORDS AND DEFINITIONS BY CATEGORY

APPENDIX B

LIST OF CLASS WORDS AND DEFINITIONS BY CATEGORY

(U) The following is a list of class words that can be used to support the naming of Generic Elements. The class word is used to specify the type of information contained in a domain. Through the naming conventions, the domain specified by the class word (plus a modifier and qualifiers) is associated with a data element. Listed below are the class words segregated by category:

A. QUALITATIVE

1. IDENTIFICATION CLASS WORDS

(a) NAME--A designation for an object expressed in a word or words.

(b) ABBREVIATION--A shortened form of a word, phrase, or name used to represent the complete form. Mnemonics are considered abbreviations.

(c) CODE--A group of alphabetic letters and/or digits that represent a specific name. Acronyms are considered codes.

(d) IDENTIFIER--A sequence of alphabetic characters that serve to indicate some object.

(e) NUMBER--A nonquantitative number associated with an object.

2. DESCRIPTIVE CLASS WORDS

(a) CATEGORY--A specifically defined division or subset in a system of classification in which all items share the same concept of taxonomy.

(b) TEXT--An unformatted character string descriptive field.

B. QUANTITATIVE

1. TIME-RELATED CLASS WORDS

(a) AGE--The length of time a person or thing has lived or existed.

(b) DATE--A calendar date, commonly expressed by month, day, and year.

(c) DATE-TIME-GROUP--Time (day, hour, and minute) and date (month and year) in the format DDHHMMZMMMYY.

(d) TIME--A specific point in the day expressed within the 2400 hours clock.

(e) YEAR--The period of time as measured by the Gregorian calendar, consisting of approximately 365 days beginning on January 1 and ending on December 31.

2. POSITION-RELATED CLASS WORDS

(a) LOCATION--A position or site on the earth's surface represented by Mercator Projection grid coordinates.

(b) LATITUDE--Angular distance north or south from the earth's equator measured through 90 degrees. The format is degrees, minutes, seconds, hemisphere.

(c) LONGITUDE--The arc or portion of the earth's equator intersected between the meridian of a given place and the prime meridian (Greenwich, England) expressed in degrees. The format is degrees, minutes, seconds, hemisphere.

3. MEASUREMENT CLASS WORDS

(a) ACCELERATION--The rate of change of velocity.

(b) ANGLE--The measurement of the space formed by two lines diverging from a common point.

(c) AREA--The number of unit squares equal in measure to the surface.

(d) DENSITY--The amount of particular items of interest per unit of measure.

(e) DEPTH--The linear measurement downward, backward, or inward.

(f) DISTANCE--The extent of advance away or along from a point considered primary or original.

(g) FLOW--The continuous movement, circulation, or throughput of a substance.

(h) FORCE--The intensity of strength, vigor, or power.

(i) HEIGHT--The distance from the base to the top of something standing upright.

(j) HUMIDITY--The amount of water vapor in the air.

(k) LENGTH--The longer or longest dimension of an object.

(l) MASS--The physical volume or bulk of a body.

(m) PRESSURE--A measure of applied force per unit area.

(n) RANGE--The extent covered by something.

(o) TENSION--A measure for tautness caused by pulling or stretching something.

(p) TEMPERATURE--A measure of the degree of hotness or coldness of something.

(r) TORQUE--A measure for a turning or twisting force.

(s) VELOCITY--The rate of motion.

(t) VISCOSITY--The degree to which a substance resists flowing.

(u) VOLUME--The amount of space occupied by a three-dimensional figure as measured in cubic units.

(v) WEIGHT--The force with which a body or object is attracted toward the earth by gravitation.

(w) WIDTH--The measurement taken at right angles to the length.

(x) SIZE--The physical dimensions or magnitude of something.

4. COMPUTATIONAL CLASS WORDS

(a) AMOUNT--The monetary value arrived at by counting.

(b) COST--The amount paid or required in payment for a purchase.

(c) QUANTITY--Non-monetary numeric value arrived at by counting.

C. MEASUREMENT AND COMPUTATIONAL CLASS WORD QUALIFIERS

1. AVERAGE--The arithmetic mean of numbers.
2. MEDIAN--The middle value in a distribution, above and below which lie an equal number of values.
3. PERCENT--One part of a hundred.
4. RATIO--The calculated relation in degree or number between two similar things.
5. TOTAL--The final sum of amounts, costs, or quantity.

(U) The above list is by no means exhaustive in nature, but rather represents a starting point based on some ongoing efforts. It is envisioned that this list will grow as the need for additional class words are identified. However, the class word list that is adopted must be controlled and kept to a minimum.

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APPENDIX C

ARCHITECTURAL MODIFIERS AND PRIME WORD LIST

APPENDIX C

ARCHITECTURAL MODIFIERS AND PRIME WORD LIST

(U) The following is a list of the architectural modifiers and prime words that can be used to support the naming of generic elements and data elements. The prime word represents the objects to which an application data element belongs. The architectural modifier is at a macro-organizational level, or in other words, the first major division of information within a specific organization. The architectural modifier provides the logical connection between the data element and an organization's data architecture or data model. The architectural modifier should be the first word in the data element name and may also serve as the prime word for the data element name if so desired. Architectural modifiers should appear on the prime word list; however, not all prime words are architectural modifiers.

(U) An initial set of architectural modifiers and prime words has been listed below. As time progresses and experience is gained, this list would change accordingly. Other prime words would be recommended for inclusion to the prime word list.

(U) The architectural modifiers have been mapped below to their information class and Army Data Architecture Subject Area. The architectural modifier within each subject area may be associated with any information class within that subject area. However, an architectural modifier may not be associated with an information class outside of the subject areas assigned below. "Associated" means appearing as the first word in a data element name that supports a specific information class.

(U) The architectural modifiers listed below, in accordance with the naming conventions specified in Chapter 6, are used as modifiers of prime words.

A. ARCHITECTURAL MODIFIER MAPPING

1. DATA MODEL SUBJECT AREA: Acquisition

INFORMATION CLASSES:

- Personnel Accessions
- Materiel Acquisition
- Facilities Acquisition
- Industrial Capability
- Materiel Improvement

ARCHITECTURAL MODIFIERS:

Acquisition
Industrial

2. DATA MODEL SUBJECT AREA: Budget

INFORMATION CLASSES:

Cash/Funds Authorizations
Program/Budget Execution
Accounting
Budget

ARCHITECTURAL MODIFIERS:

Accounting
Budget
Finance
Resource

3. DATA MODEL SUBJECT AREA: Commercial Activities

INFORMATION CLASSES:

Commercial Activities

ARCHITECTURAL MODIFIERS:

Commercial
Contractor
Supplier
Vendor

4. DATA MODEL SUBJECT AREA: Contracts

INFORMATION CLASSES:

Contracts

ARCHITECTURAL MODIFIERS:

Contract
Agreement

5. DATA MODEL SUBJECT AREA: Crisis Operations

INFORMATION CLASSES:

Crisis Operation

ARCHITECTURAL MODIFIERS:

Catastrophic
Crisis
Disaster

Relief
Special
Unconventional

6. DATA MODEL SUBJECT AREA: Facilities

INFORMATION CLASSES:

Installation
Facilities Maintenance
Facilities Disposal

ARCHITECTURAL MODIFIERS:

Annex	Maintenance
Base	Office
Camp	Post
Cemetery	Production
Construction	Range
Engineering	Reservation
Facility	Storage
Housing	Terminal

7. DATA MODEL SUBJECT AREA: Funds

INFORMATION CLASSES:

Funds
Disbursement

ARCHITECTURAL MODIFIERS:

Appropriated
Compensation
Disbursement
Funds
Receipt

8. DATA MODEL SUBJECT AREA: Government Liaison

INFORMATION CLASSES:

External Guidance
Foreign Liaison
Government Liaison

ARCHITECTURAL MODIFIERS:

Executive	International
External	Interservice
Foreign	Liaison

Government
Interheadquarters
National

9. DATA MODEL SUBJECT AREA: Guidance & Doctrine

INFORMATION CLASSES:

Strategic Direction

Doctrine

ARCHITECTURAL MODIFIERS:

Command
Direction
Directive
Policy
Priority
Regulation
Strategic
Strategy

10. DATA MODEL SUBJECT AREA: Information Management

INFORMATION CLASSES:

Information Management

ARCHITECTURAL MODIFIERS:

Audio
Automation
Communication
Computer
Information
Library
Printing
Publication
Record
Telecommunications
Visual

11. DATA MODEL SUBJECT AREA: Intelligence

INFORMATION CLASSES:

Intelligence

ARCHITECTURAL MODIFIERS:

Counterintelligence
Deception
Enemy
Geographic
Intelligence
Mapping
Nuclear Surety
Reconnaissance
Topology
Weather

12. DATA MODEL SUBJECT AREA: Materiel

INFORMATION CLASSES:

Materiel Distribution

Materiel Inventory

Materiel Maintenance

Materiel Disposition

ARCHITECTURAL MODIFIERS:

Developer	Major-Item
Equipment	Materiel
Inventory	Supply
Logistic	

13. DATA MODEL SUBJECT AREA: Operational Testing (OT)

INFORMATION CLASSES:

Testing (OT)

ARCHITECTURAL MODIFIERS:

Evaluation
Test

14. DATA MODEL SUBJECT AREA: Operations Plans

INFORMATION CLASSES:

Plans (Operation)

Deployment

ARCHITECTURAL MODIFIERS:

Air-Defence	Chemical	Long-range	Operation
Air-Ground	Defence	Manoeuver	Operational
Assessment	Deployment	Mobilization	Plan
Biological	Exercise	Movement	Psychological
Battlefield	Fire-Support	Nuclear	Transport
Barrier	Intertheatre	Obstacles	Warfare
Capability	Intratheatre	Offense	

15. DATA MODEL SUBJECT AREA: Personnel

INFORMATION CLASSES:

Personnel Distribution

Personnel Strength

Casualties

Personnel Sustainment

Personnel Transitions

ARCHITECTURAL MODIFIERS:

Civilian	Member
Dependent	Military
Equal-Opportunity	Personnel

Family
Local
Union

16. DATA MODEL SUBJECT AREA: Public Affairs

INFORMATION CLASSES:

Public Affairs

ARCHITECTURAL MODIFIERS:

Affair
Public

17. DATA MODEL SUBJECT AREA: Readiness

INFORMATION CLASSES:

Force Readiness

ARCHITECTURAL MODIFIERS:

Force
Readiness

18. DATA MODEL SUBJECT AREA: Research and Development

INFORMATION CLASSES:

RDTE

ARCHITECTURAL MODIFIERS:

Electronic
Experiment
Development
Laboratory
Life-Science
Protocol
Research
Sample
Science
Subject
Technology

19. DATA MODEL SUBJECT AREA: Security

INFORMATION CLASSES:

Security

Law Enforcement

ARCHITECTURAL MODIFIERS:

Discipline
Law-and-Order
Prisoner
Physical
Security
Surveillance

20. DATA MODEL SUBJECT AREA: Security Assistance
    INFORMATION CLASSES:
        Security Assistance
        ARCHITECTURAL MODIFIERS:
            Security
            Assistance

21. DATA MODEL SUBJECT AREA: Structure
    INFORMATION CLASSES:
        Structure
        Manpower Requirements
        Manpower Authorizations
        Materiel Requirements
        Materiel Authorizations
        Facilities Requirements
        Facilities Authorizations
        ARCHITECTURAL MODIFIERS:
            Authorization
            Manpower
            Structure

22. DATA MODEL SUBJECT AREA: Studies Program
    INFORMATION CLASSES:
        Study Program
        ARCHITECTURAL MODIFIERS:
            Study

23. DATA MODEL SUBJECT AREA: Support Activities
    INFORMATION CLASSES:
        Inspection Results
        Audit Findings
        Legal Support
        Community Support
        Health Support
        Safety
        Individual Entitlement

Claims

ARCHITECTURAL MODIFIERS:

Administration	Installation
Audit	Investigation
Clinic	Legal
Community	Religious
Health	Safety
Hospital	Soldier
Inspection	Support

24. DATA MODEL SUBJECT AREA: Training

INFORMATION CLASSES:

Institutional Training

Individual and Unit Proficiency

ARCHITECTURAL MODIFIERS:

Institutional

Training

25. DATA MODEL SUBJECT AREA: Transportation (non-Army)

INFORMATION CLASSES:

Transportation (non-Army)

ARCHITECTURAL MODIFIERS:

Air

Land

Rail

Sea

Transportation

26. DATA MODEL SUBJECT AREA: Unit(s) and Organization(s)

INFORMATION CLASSES:

Review and Analysis Results

Internal Management

ARCHITECTURAL MODIFIERS:

Army	Report
Documentation	Reserve
Goal	Standard
Management	Tactical
Organization	Unit
Procedure	

B. PRIME WORD LIST

Accounting	Berth	Crane	Fire-Support
Acquisition	Biological	Crisis	Force
Administration	Budget	Deception	Foreign
Affair	Bunker	Defence	Fuel
Agency	Camp	Departure	Funds
Agreement	Capability	Dependent	Geographic
Air	Cargo	Deployment	Goal
Air-Defence	Carrier	Description	Government
Air-Ground	Catastrophic	Developer	Harbour
Aircraft	Cemetery	Development	Health
Airfield	Channel	Direction	Hospital
Airlift	Chart	Directive	Hostilities
Airport	Chemical	Disaster	Housing
Ammunition	Civilian	Disbursement	Ice
Anchorage	Clinic	Discipline	Industrial
Annex	Combat	Diseased	Information
Appropriated	Command	Document	Inspection
Apron	Commercial	Electricity	Installation
Arctic	Communication	Electronic	Institutional
Army	Community	Encyclopedia	Intelligence
Arresting-Gear	Compensation	Enemy	Interheadquarter
Arrival	Complex	Engineering	International
Assessment	Component	Equipment	Interservice
Asset	Computer	Evacuee	Intertheatre
Assistance	Construction	Evaluation	Intratheatre
Audio	Container	Executive	Inventory
Authorization	Contract	Exercise	Investigation
Automation	Contractor	Experiment	Item
Barrier	Conversion	External	Laboratory
Base	Counterintelligence	Facility	Land
Battlefield	Country	Family	Language

Bed
Legal
Liaison
Library
Life-Science
Lighter
Local
Location
Logistic
Long-range
Maintenance
Major-Item
Management
Manoeuvre
Manpower
Mapping
Materiel
Medical
Member
Message
Military
Mission
Mobilization
Movement
Nation
National
Non-Evacuee
Nuclear
Nuclear Surety
Obstacles
Offense
Office
Craft
Operation
Operational
Organization
Outpatient
Patient
Personnel
Petroleum
Physical
Pipeline
Plan
Policy
Port
Post
Printing
Priority
Prisoner
Procedure
Production
Program
Project
Protocol
Psychological
Public
Publication
Rail
Railroad
Ramp
Range
Readiness
Receipt
Reconnaissance
Finance
Record
Regulation
Relief
Religious
Report
Requirement
Research
Reservation
Reserve
Resource
Road
Runway
Safety
Sample
Science
Sea
Seaport
Security
Sequence
Service
Ship
Soldier
Special
Standard
State
Stock
Storage
Strategic
Strategy
Structure
Study
Law-and-Order
Subject
Supplier
Supply
Support
Surveillance
Tactical
Technology
Telecommunications
Terminal
Test
Theatre
Tidal
Topology
Training
Transport
Transportation
Tugboat
Unconventional
Union
Unit
Vendor
Visual
War
Warfare
Water
Weather
Wharf
Work
Zone

APPENDIX D

"OF-LANGUAGE" NAMING CONVENTION

APPENDIX D

"OF-LANGUAGE" NAMING CONVENTION

(U) In its discussion of data terminology,[1] AM 96-1-4 discusses only one naming convention, the so-called "OF-Language" (based on a proprietary concept developed by IBM), and recommends it for adaption, as appropriate, in ACE.

(U) The general format for a name in the "OF-Language" convention is:

P . QQQ [R SSS][R SSS] [R SSS]

where:

P	indicates type of name (from a list of valid types given below)
.	means "OF"
QQQ	is a global noun (e.g., listed in a data dictionary)
R	is a connector for descriptions (from a list of valid connectors given below)
SSS	is a descriptor (adjective).

Connector/descriptor pairs, denoted [R SSS], are used optionally and may be repeated as appropriate.

(U) Valid type-of-name ["P"] values are: Amount (A), Code (C), Date (D), Flag (F), Constant (K), Name (N), Number (O), Percent (P), Quantity (Q), Text (T), and Control (X). Valid values of the connector ["R"] are:

/	meaning "which is"
-	meaning "Compound" [the symbol is hyphen]
$	meaning "OR"
#	meaning "AND"
@	meaning "by," "per", "for", or "with"
_	meaning "initiator" [the symbol is underscore].

(U) The following are valid examples of names in the "OF-Language," taken from AM 96-1-4:

A.SALARY/BASE#COMMISSION	Amount of salary that is Base and Commission

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[1] (U) "Data Terminology," Annex A, AM 96-1-4 [Ref. 6], Section 1.L.

Q.AIRCRAFT/STANDBY	Quantity of Aircraft that are on standby
N.COUNTRY/NATO	Name of Country that is in NATO
C.COUNTRY/NATO	Code of Country that is in NATO
P.MINES/REMAINING/ACOUSTIC	Percentage of mines remaining that are acoustic.

APPENDIX E

ATTRIBUTE LIST

APPENDIX E

ATTRIBUTE LIST

1. GENERIC ELEMENT

1.1 Administrative Attributes

(U) Administrative attributes for generic elements are:

- INFORMATION GENERIC ELEMENT NAME - A character string given to a generic element based on a class word that identifies a domain.
- INFORMATION ELEMENT APPROVAL DATE - The date a standard element is approved as an ATCCIS standard.
- INFORMATION ELEMENT CLASS WORD NAME - A character string (word) from a reserved list that identifies the generic element.
- INFORMATION ELEMENT MODIFIER NAME - A character string that further describes a characteristic of an object, a relationship between objects, or the object itself.
- INFORMATION GENERIC ELEMENT QUALIFIER NAME - A character string that modifies a class word. It is normally associated with quantities.
- INFORMATION GENERIC ELEMENT DEFINITION TEXT - narrative describing the general intent of a generic element.

1.2 Relational Attributes

(U) Relational attributes for generic elements are:

- INFORMATION ELEMENT STANDARDIZATION AUTHORITY ATTRIBUTE IDENTIFIER - The NATO, SHAPE, or Command organization that approved the element.
- INFORMATION ELEMENT AUTHORIZATION DOCUMENT NAME - A character string given to the document (directive, regulation, publication, or other) that authorizes the generic element.

1.3 Representational Attributes

(U) Representational attributes for generic elements are:

- INFORMATION ELEMENT DATA TYPE CATEGORY - The editing type of the data value associated with an element.
- INFORMATION ELEMENT MAXIMUM DATA VALUE LENGTH - The maximum number of characters for an attribute.
- INFORMATION GENERIC ELEMENT DOMAIN DEFINITION TEXT - Narrative describing the acceptable set of data values for a generic element.
- INFORMATION DATA VALUE TYPE IDENTIFIER - An indicator specifying the data value type of an information element.
- INFORMATION ELEMENT JUSTIFICATION CATEGORY - The positional justification of an element within a data field.
- INFORMATION DATA VALUE SOURCE LIST TEXT - The source in which lengthy codes are enumerated for the user. The source can be either manual or automated medium.

1.3.1 Relating to Qualitative Data

(U) Representational attributes relating to qualitative data for generic elements are:

- INFORMATION DATA VALUE NAME - An occurrence of a character string given to an acceptable set of data values.
- INFORMATION DATA VALUE DEFINITION TEXT - Narrative describing a data value name or number specified in a domain set.

1.3.2 Related to Quantitative Data

(U) Representational attributes relating to quantitative data for generic elements are:

- INFORMATION QUANTITATIVE DATA HIGH RANGE NUMBER - The largest value for quantitative data, when a domain set is expressed as a possible range of values.
- INFORMATION QUANTITATIVE DATA LOW RANGE NUMBER - The smallest value for quantitative data, when a domain set is expressed as a possible range of values.
- INFORMATION QUANTITATIVE DATA SCALE NUMBER - The integer that determines the decimal point placement in an element for fixed point or floating point data types.

- INFORMATION QUANTITATIVE DATA VALUE NUMBER - The set of values for quantitative data, when mathematical operations must be performed on "codes."
- INFORMATION QUANTITATIVE DATA VALUE DEFINITION TEXT - Narrative describing a data value name or number specified in a domain set.

2. DATA ELEMENT

2.1 Administrative Attributes

(U) Administrative attributes for data elements are:

- INFORMATION DATA ELEMENT NAME - A character string given to a data element based on a prime term and a generic element name.
- INFORMATION PRIME WORD NAME - A character string in a data element name that represents the data grouping to which the data element belongs.
- INFORMATION DATA ELEMENT ARCHITECTURAL MODIFIER NAME - A data element character string directly related to a subject area in the ATCCIS data architecture.
- INFORMATION DATA ELEMENT DESCRIPTION TEXT - Narrative describing a data element.
- INFORMATION DATA ELEMENT MNEMONIC ABBREVIATION - A short form of a data element character string.
- INFORMATION DATA ELEMENT SECURITY CATEGORY - The level of security that the value set of this data element requires.
- INFORMATION DATA ELEMENT STATUS IDENTIFIER - An indicator of the current status of a data element in relation to the standardization process.
- INFORMATION DATA ELEMENT COMMENT TEXT - Administrative comment concerning a data element.

2.1.1 Defined at the Generic Element Level

- INFORMATION ELEMENT APPROVAL DATE
- INFORMATION DATA ELEMENT QUALIFIER NAME
- INFORMATION ELEMENT MODIFIER NAME

2.2 Relational Attributes

(U) Relational attributes for data elements are:

- INFORMATION DATA ARCHITECTURE SUBJECT AREA NAME - A character string given to a data architecture entity subject area.
- INFORMATION CLASS NAME - A character string given to the class of information to which a data element is assigned in accordance with the Information Model.
- INFORMATION PROCESS NAME - A character string given to a process that creates an information class in accordance with the current Information Model.
- INFORMATION CLASS PROPONENT NAME - A character string given to an organization that has been assigned responsibility for an information class.
- INFORMATION DATA ELEMENT RESPONSIBLE OFFICE NAME - A character string given to the office and/or person designated by the information class proponent as the functional expert for defining, reviewing, and updating a data element and its attributes.

2.3 Representational Attributes

(U) Representational attributes for data elements are:

- INFORMATION DATA ELEMENT DOMAIN DEFINITION TEXT - Narrative describing the data values acceptable for a data element. The specification for the element must be the set or subset of a generic element definition. It may not contain data values outside the set. This definition includes the range of acceptable values.
- INFORMATION DATA ELEMENT TIMELINESS IDENTIFIER - An indicator of how often data values must be updated.
- INFORMATION DATA ELEMENT LENGTH - The maximum number of characters in a standard data element.

2.3.1 Defined at the Generic Element Level

- INFORMATION DATA VALUE TYPE IDENTIFIER
- INFORMATION ELEMENT JUSTIFICATION CATEGORY
- INFORMATION ELEMENT CODE LOCATION

2.3.2 Related to Qualitative Data

(U) Representational attributes relating to qualitative data for data elements are:

- INFORMATION QUALITATIVE DATA VALUE ACCURACY NUMBER PERCENT - An indicator of how accurate a qualitative data value must be.

2.3.3 Related to Qualitative Data Defined at the Generic Element Level

- INFORMATION DATA VALUE NAME
- INFORMATION DATA VALUE DEFINITION TEXT

2.3.4 Related to Quantitative Data

(U) Representational attributes relating to quantitative data for data elements are:

- INFORMATION QUANTITATIVE DATA ACCURACY IDENTIFIER - An indicator of how precise a quantitative data value must be.
- INFORMATION DATA ELEMENT CALCULATION FORMULA TEXT - Narrative expressing the algorithmic formula for a data element that is derived.

2.3.5 Related to Quantitative Data Defined at the Generic Element Level

- INFORMATION QUANTITATIVE DATA HIGH RANGE NUMBER
- INFORMATION QUANTITATIVE DATA LOW RANGE NUMBER
- INFORMATION QUANTITATIVE DATA SCALE IDENTIFIER
- INFORMATION DATA VALUE DEFINITION TEXT
- INFORMATION QUANTITATIVE DATA VALUE NUMBER

3. DATA ELEMENT ALIAS

3.1 Administrative Attributes

(U) Administrative attributes for data element aliases are:

- INFORMATION DATA ELEMENT ALIAS NAME - A character string given to a nonstandard data element.

- INFORMATION DATA ELEMENT ALIAS HOST APPLICATION NAME - A character string given to an application or program that contains a data element alias.
- INFORMATION DATA ELEMENT ALIAS HOST SYSTEM NAME - A character string given to an information system that contains a data element alias.

3.2 Relational Attributes

(U) Relational attributes for data element aliases are:

- INFORMATION DATA ELEMENT ALIAS RESPONSIBLE OFFICE NAME - A character string given to the office and/or person designated by the information class proponent as the functional expert for defining, reviewing, and updating a data element alias and its attributes.

3.2.1 Defined at the Data Element Level

- INFORMATION DATA ELEMENT NAME

3.3 Representational Attributes

(U) The representational attributes at the data element alias level are identical to the Data Element Level, except they are used only to report exceptions where that alias deviates from the established standard.

4. RELATION OF ATTRIBUTES TO OTHER STANDARDS

(U) The attributes listed in this section were identified in ISO/IEC DP 10027, 1 April 1988, from the Element Entity level of the IRDS. Other attributes have been added to the attribute set associated with the development of a data model to support the standardization process.

APPENDIX F

NATIONAL INITIATIVES ON DATA MANAGEMENT

APPENDIX F

NATIONAL INITIATIVES ON DATA MANAGEMENT

(U) This Appendix briefly describes some of the national initiatives being conducted to define a policy for data management and standardization.

I. DATA MANAGEMENT POLICY FOR THE U.S. ARMY

(U) The U.S. Army has recently published an Army Regulation (AR 25-9) [Ref. 35] to prescribe policies, responsibilities, and concept of operation for the management of data used in manual and automated information systems throughout the U.S. Army. This document was coordinated with ISO, ANSI, and the U.S. National Bureau of Standards, as well as with the U.S. Joint Chiefs of Staff, to ensure alignment in the area of a data element naming convention. The Army plans to maintain a Service-wide data encyclopedia of information about all data elements that have gone through a standardization process and are designated as Army standard elements. AR 25-9 addresses six activities that form the Army Data Management and Standards Program:

- Strategic Data Planning. The development and maintenance of data-related initiatives in integrated organizational multiyear long-range plans.
- Data Element Standards. The standardization and management of data elements and their attributes.
- Information Management Control. The interface between data management and control of the collection and reporting of management information requirements.
- Data Security. The policies and procedures required to protect and safeguard data and information, including operational security.
- Data Synchronization. The policies and procedures that govern the consistency, accuracy, reliability, and timeliness of data used and generated by the Army.
- Database Development and Maintenance. The policies and standards that guide design, development, documentation, and integration of data bases.

(U) AR 25-9 provides for three types of standard elements: reference element, data element, and data element alias. A reference element is a structure used to specify the domain or the range of acceptable values. A data element consists of a data element name,

together with attributes describing what it is, its representation, and relationships to other objects. The data element name includes the name of the reference element that has the appropriate range of acceptable values. Note that it is the structure of a data element that is standardized, not the use of a data element. Data element aliases identify data elements in use in specific systems and locations, and they are used, temporarily, to bridge the gap between standard elements and nonstandard names being used in fielded systems.

APPENDIX G

BACKGROUND, OBJECTIVE, AND ADDITIONAL GUIDANCE

APPENDIX G

BACKGROUND, OBJECTIVE, AND ADDITIONAL GUIDANCE

(U) This IDA Memorandum Report was written in response to Task Order T-J1-246 and Amendment No. 6. Those portions of the task order that pertain to the background and objectives of the task, and the additional guidance provided therein by the sponsoring office, are reprinted here.

2. BACKGROUND:

The tactical ADP portion of the NATO Long Term Defense Program (LTDP) proposed that command and control systems be built to common specifications. The Deputy SACEUR initiated a study to determine the feasibility of the nations in the Central Region commonly developing an Automated Army Tactical Command and Control Information System (ATCCIS) for deployment in the post-1995 timeframe. Commitments for supporting this effort were obtained from US, UK, and FRG Army Chiefs of Staff. These nations provided information on their operational doctrine, procedures, functions, and information exchange requirements for their maneuver forces, as well as their operational requirements for an automated CCIS and information on the ADP systems that they are currently developing to support their maneuver forces. This information was used in the initial phase of the study to determine the extent to which similarities and differences in national requirements for automated CCISs would indicate that a commonly developed system is potentially feasible. The results of ths initial phase were positive. SHAPE has requested that their nations complete the study and has received US, UK and FRG Army Chiefs of Staff commitments.

3. OBJECTIVE:

The objective of this phase II effort of the study is to assist SHAPE in defining the military objectives and basic operational requirements for a common ATCCIS that achieves interoperability to ADP systems. The capabilities of ADP systems are to be compared to the concept of operations of each of the nations to determine the extent to which such a common ATCCIS could accommodate the requirements of each nation and to identify issues remaining to be resolved before such a system could be employed in the Central Region in post-1995 time period.

4. ADDITIONAL GUIDANCE:

The FY 1988 task includes:

a. Continue tasks to support the establishment of the organizational and operational concept, operational requirements, and technical concept for the ATCCIS.

b. Continue review of the U.S. operational doctrine, procedures, functions, and information exchange requirements for the maneuver forces and operational requirements for automated CCIS and the ADP systems currently being developed with a view towards post-1995 as necessary to conduct the study. This specifically includes efforts underway to develop and support dispersed command posts.

APPENDIX H

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GLOSSARY

AAP	Allied Administrative Publication (MAS)
ACCIS	Automated Command and Control Information System (NATO)
ACE	Allied Command Europe (NATO)
ACP	Allied Communications Publication (NATO)
ADSIA	Allied Data Systems Interoperability Agency
ADatP	Allied Data Publication
ADP	Automatic Data Processing
AM	ACE Manual
ANDIP	American National Directory for Information Processing
ANSI	American National Standards Institute
ASCE	Association Service Control Elements (OSI)
ASN	Abstract Syntax Notation (OSI)
ATCCIS	Army Tactical Command and Control Information System (SHAPE)
ATP	Allied Tactical Publication
C2	Command and Control
CCIS	Command and Control Information System
CCITT	Comite Consultatif International de Telegraphique et Telephonique (International Telegraph and Telephone Consultative Committee)
CIEG	Common Information Exchange Glossary
CIEL	Common Information Exchange Language
DAFTG	Database Architecture Framework Task Group (ANSI)
DALIMS	NATO Data Link Message Standards
DMF	Data Management Facility (ATCCIS)
DMRM	Data Management Reference Model
DMS	Data Management Subsystem (ACE CCIS)
DP	Draft Proposal (ISO)
FORMETS	NATO Message Text Formatting System
GLOT	Glossary of Operational Terms
ICSI	International Coding System Identifier (ISO DP 7826)
IEC	International Electrotechnical Commission
IER	Information Exchange Requirement

IRDS	Information Resource Dictionary System
ISO	International Organization for Standardization
ISWG	Information Systems Working Group (NACISO)
JTC	Joint Technical Committee
LTDP	Long-Term Defense Plan (NATO)
M	Modifier
MAS	Military Agency for Standardization (NATO)
MTF	Message Text Format
NACISA	NATO Communications and Information Systems Agency
NACISC	NATO Communications and Information Systems Committee
NACISO	NATO Communications and Information Systems Organization
NCCIS	NATO Command and Control Information System
NCIS	NATO Common Interoperability Standards
NIAG	NATO Industrial Advisory Group
NIMP	NATO Interoperability Management Plan
NIPD	NATO Interoperability Planning Document
NIST	U.S. National Institute of Science and Technology
NISTIR	NBS Interim Report
OSI	Open Systems Interconnection
PW	Prime Word
PWG	Permanent Working Group
Q	Qualifier
SC	Sub-committee (ISO); Study Committee
SCF	Service Control Facility (ATCCIS)
SG	Sub-group
SHAPE	Supreme Headquarters Allied Powers Europe (NATO)
SMF	System Management Facility (ATCCIS)
STANAG	NATO Standardization Agreement
STC	SHAPE Technical Centre
STRADIS	Structured Analysis, Design, and Implementation of Information Systems
TADIL	Tactical Data Link
TCIS	Technical Common Interface Standards (TSGCEE SG9)

TF	Transfer Facility (ATCCIS)
TM	Technical Manual
TSGCEE	Tri-Service Group for Communications Electronic Equipment
WG	Working Group
WP	Working Paper (ATCCIS)

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